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# Waste Source Investigations, Kingsport, Tennessee

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ENVIRONMENTAL PROTECTION AGENCY
OFFICE OF ENFORCEMENT

# REPORT ON

# WASTE SOURCE INVESTIGATIONS
# KINGSPORT, TENNESSEE

National Field Investigation Centers
Denver and Cincinnati
and
Region IV, Atlanta, Georgia

April 1973

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# GLOSSARY OF TERMS

| | |
|---|---|
| BOD | - Biochemical Oxygen Demand, 5-day |
| COD | - Chemical Oxygen Demand |
| TOC | - Total Organic Carbon |
| SS | - Suspended Solids |
| TKN | - Total Kjeldahl Nitrogen |
| $NH_3$-N | - Ammonia as Nitrogen |
| $NO_3 + NO_2$-N | - Nitrate + Nitrite as Nitrogen |
| Total-P | - Total Phosphorus |
| Cr | - Chromium |
| Mn | - Manganese |
| Fe | - Iron |
| Cu | - Copper |
| Zn | - Zinc |
| Sn | - Tin |
| Hg | - Mercury |
| Pb | - Lead |
| RM | - River Mileage (e.g., 142.15/4.04) with first number denoting distance from the mouth of the Holston River to the confluence with a tributary upstream, and second value indicating distance upstream of the mouth of the tributary stream. |
| $TL_m$ | - Median Tolerance Limit, the concentration of toxicant in water that causes a 50 percent mortality of the test fish over a specified time period. |
| WWTP | - Wastewater Treatment Plant |

cfm - Flow rate given in cubic feet per minute

cfs - " " " " " " " second

gpm - " " " " gallons per minute

gpd - " " " " " " day

gpw - " " " " " " week

mgd - " " " " million gallons per day

mg/l - Concentration given in milligrams per liter

mg/kg - " " " " " kilograms

µg/l - " " " micrograms per liter

µmhos/cm - Unit of specific conductance (mho--the inverse of the standard unit of electrical resistance, the ohm) measured over a 1-centimeter distance, conventionally at 25°C.

ppm - Concentration given in parts per million

# I. INTRODUCTION

## A. BACKGROUND

Wastes from municipal and industrial sources pollute the South Fork of the Holston River as it flows through the City of Kingsport, Tennessee, and the Holston River* downstream from Kingsport. A study survey is given conducted by the Federal Water Quality Administration, Department of the Interior, Region IV, during June-July, 1969, reported that:[1/]

1. Wastewater discharges from the Tennessee Eastman Company (TEC); Holston Army Ammunition Plant, Areas A and B (HAAP-A & B); Mead Papers, a division of Mead Corporation; Kingsport Wastewater Treatment Plant; and Holliston Mills, Incorporated, contributed approximately 137,500 lb/day of BOD and 22,000 lb/day of total nitrogen to the Holston River system.
2. Cooling-water discharges from TEC and HAAP-A raised the ambient water temperature of the South Fork of the Holston River by about 12°C.
3. Attached aquatic weeds (primarily *Potamogeton pectinatus*) covered the bottom of the Holston River throughout the reach of the 23 river miles studied. This resulted in a cyclical variation of oxygen levels and caused violations of the Tennessee Stream Standards for dissolved oxygen.

The Tennessee Water Quality Control Board subsequently established effluent requirements that specified that those industries discharging to the Holston River and its tributaries provide a minimum BOD removal of 85 percent by April 1972. The 1969 report[1/] concluded that the BOD load discharged in the study reach must be reduced by 92 percent if water quality conditions were to improve. It was further concluded that the two largest dischargers, TEC and HAAP-B, must reduce the total Kjeldahl nitrogen in the effluents by 92 percent. To date the 85-percent BOD-removal goal has not been met.

---

* The Holston River and the South and North Forks of the Holston River are interstate streams.

However, with the passage of the Federal Water Pollution Control Act Ammendments of 1972, previous State goals and implementation plans will be reviewed to conform with the new Act. The State of Tennessee is planning to hold a public hearing regarding the water pollution problems in the Kingsport area, but no date has been set. Additionally, the State has not requested interim authority from EPA to issue permits under the 1972 Amendments.

## B. 1972 WATER-QUALITY INVESTIGATIONS

The National Field Investigations Center-Denver (NFIC-D) was requested by EPA Region IV, Atlanta, Georgia, to conduct waste-source evaluations and a stream survey in the Kingsport, Tennessee, area -- Holston River Basin with the following objectives:

1. Determine the quality and quantity of waste pollutants discharged to the Holston River and its tributaries so that effluent limitation can be established pursuant to the Federal Water Pollution Control Act Amendments of 1972.
2. Ascertain the changes -- as a result of waste discharges, in

the water quality of the Holston River and its tributaries in terms of specific pollutants, i.e., nitrogen, phosphorus, and organic chemicals.

3. Evaluate present pollution control measures and determine what additional control measures are necessary for the protection and enhancement of receiving water quality.

The National Field Investigations Centers, Denver and Cincinnati, conducted the investigations during the period 27 November through 15 December 1972.

The cooperation extended by the City of Kingsport, the industries, and State and Federal agencies is gratefully acknowledged.

## II. SUMMARY AND CONCLUSIONS

### A. STREAM SURVEY

Discharges to the South Fork of the Holston River and to the Holston River, made during December 1972, contained average daily waste loads of approximately 111,500 lb of BOD; 61,000 lb of TOC; 11,600 lb of total Kjeldahl nitrogen (TKN); and 5,000 lb of nitrite + nitrate-nitrogen. This includes measured loads from Tennessee Eastman Company (TEC), Holston Army Ammunition Plant (HAAP) Areas A & B, ASG Industries, Penn-Dixie Cement Corporation, Mead Papers, and Holliston Mills and the estimated waste loads (based on operating records) from the Kingsport Wastewater Treatment Plant. The discharges from TEC, HAAP Areas A & B and Mead Papers accounted for more than 95 percent of the BOD load, 99 percent of the TKN and 100 percent of the nitrite + nitrate nitrogen.

During the 1969 FWQA study, it was found that TEC, HAAP (Areas A and B), Mead Papers, Kingsport Wastewater Treatment Plant, and Holliston Mills discharged approximately 137,500 lb/day of BOD and 19,500 lb/day of TKN (TEC and HAAP B contributed 99 percent of the latter). That study concluded that in order to maintain a minimum dissolved oxygen concentration of 3.0 mg/l in the Holston River downstream of the confluence of the North and South Forks, these waste loads must be reduced to no more than approximately 14,000 lb of BOD and 1,950 lb of TKN to adequately protect the receiving waters. In order to maintain a minimum DO concentration of 5 mg/l, the official standard, the waste loads must be reduced to 6,000 lb of BOD/day and 100 lb of TKN/day in the South Fork of the

Holston River. The BOD and TKN loads discharged during December 1972 greatly exceed these recommended limits.

The hydrologic regimen of both the South Fork of the Holston River and the Holston River are affected by releases from Fort Patrick Henry Reservoir especially during off-peak power generating periods when releases are reduced to a daily average of 750 cfs i.e., 3,000 cfs for one hour and no releases for 3 hours. When this coincides with low flows in the North Fork of the Holston (20 year, three day low flow is 46 cfs), the Holston River could be reduced to about 800 cfs. During the July 1969 survey flows in the North and South Forks averaged 660 and 840 cfs, respectively. The North Fork and South Fork averaged approximately 880 and 3,130 cfs, respectively during the 1972 survey. The Holston River at Church Hill Bridge (RM 131.5) averaged 4,100 cfs i.e. the summation of the North and South Fork flows plus allowance for minor inputs.

Heavy-metals analyses of water samples disclosed a significant increase (more than 20 times — 0.03 to 0.69 mg/l) of manganese from Station 54 (RM 142.15/5.6) upstream of TEC and HAAP Area A to Station 55 (RM 142.15/1.2) downstream from all discharges to the South Fork of the Holston River. At Station 56 (RM 131.5 — downstream of HAAP Area B) the manganese concentration ranged from 0.21 to 0.40 mg/l which exceeds the Public Health Service recommended limit (0.05 mg/l) for drinking waters. The Holston River is classified suitable for domestic raw water supply at Station 56. The standards established for this use were violated (i.e. other pollutants shall not be added to the water in quantities that may be detrimental to public health or impair the usefulness of the water as a source of domestic water supply.)

## B. TENNESSEE EASTMAN COMPANY

The Tennessee Eastman Company discharged 343 mgd of cooling water and process wastewater to the South Fork of the Holston River. The total BOD and TKN loads exceeded 52,000 lb/day and 10,400 lb/day, respectively. The suspended-solids load averaged 106,000 lb/day over the five-day survey. Flows from Hales Branch (Station 12) and the Long Island lagoons (Station 17) contributed more than 49,000 lb BOD/day while the lagoon effluent contained 100 percent of the TKN discharged. The State of Tennessee has concluded that in order to protect water-quality standards for a minimum DO concentration of 5.0 mg/l in the Holston River the raw water loads from TEC must be reduced to not more than 3,350 lb BOD/day and 400 lb TKN/day. If a minimum DO concentration of 3.0 mg/l is to be maintained, the BOD and TKN loads in the effluent must not exceed 6,000 lb/day and 1,600 lb/day, respectively.

A number of organic pollutants were identified in the TEC discharges. The impact of these pollutants on aquatic life through chronic exposure is presently unknown; however, compounds such as trichlorobenzene and trichloraniline (both measured in the Long Island lagoon effluent) are known to be quite toxic and undoubtedly contribute to the toxicity of this discharge.

Static bioassay studies disclosed that wastewaters from the Long Island lagoons were toxic to fish. The 96-hr $TL_m$ derived from the static bioassays with fathead minnows was with a 64-percent waste concentration. Other static bioassays using bluegills showed the 96-hr $TL_m$ at a waste concentration of 36 percent. Based upon 1/20 of the 96-hr $TL_m$ it was calculated that toxic concentrations in the wastewater from the Long Island lagoons would have to be reduced by 95 percent in order to protect aquatic life in the South Fork of the Holston River. The discharge of toxic substances constitutes a violation of toxic Standards for Fish and Aquatic Life [Appendix A Item 3g--Toxic Substances].

Heavy-metals analyses revealed that 9,500 lb of manganese and 660 lb of zinc were discharged daily, the majority of which was contained in the effluent of the Long Island lagoons. The manganese load causes the violation of the Tennessee Water Quality Standards occurring at Church Hill Bridge (Station 56).

## C. HOLSTON ARMY AMMUNITION PLANT-AREA A

1. The HAAP installation had virtually no treatment of industrial process wastes and contaminated cooling waters. The total wastewaters, including spent cooling waters, being discharged from the Holston Army Ammunition Plant, Area A, into the South Fork of the Holston River was 43.3 mgd. These wastewaters had average measured amounts of 20,300 lb/day BOD; 19,100 lb/day COD; and 4,060 lb/day suspended solids. Due to the complex nature of HAAP wastes and their potential effect upon analytical tests, these results most likely represent minimum values.

2. The Main Outfall discharge (Station 2) was found to contain more than 90 percent of the total BOD and COD loads being discharged from the overall HAAP A complex. This discharge also represented about 75 percent

of the total facilities wastewater flow. Effluents from the ASG Industries were discharged into the upper section of the HAAP Main Outfall, amounting to approximately 3,600 lb/day of suspended solids in a waste flow of 0.52 mgd. Many of these solids settled out in the open ditch either before reaching or within the Main Outfall.

3. Bioassay studies conducted at HAAP, Area A, disclosed that wastewater discharges at Stations 2 and 8 were highly toxic to aquatic life. The coal-tar drainage (0.007 mgd) at Station 8 killed 50 percent of the fathead minnow test species after 96 hr with a waste concentration of only 0.17 percent. The Main Outfall (33.6 mgd) at Station 2 showed a 50 percent kill of test fish after 96 hr with a waste concentration of 56.0 percent. These two waste discharges alone would require that about 2,000 cfs be maintained in the South Fork and Holston Rivers to ensure no long-term impact on aquatic life because of toxicity (based upon 1/20 of the 96-hr $TL_m$). This calculated dilution flow does not include additional allowance for the many other potentially toxic waste streams presently entering the Holston River, not only from the remaining parts of HAAP A, but also HAAP B, Tennessee Eastman, and miscellaneous sources. The concentrations of toxic materials in the Holston River downstream from Kingsport, Tennessee, are approaching the levels that are toxic to fish. These toxic discharges are in violation of the General Water Quality Criteria for the Definition and Control of Pollution In the Waters of Tennessee for Fish and Aquatic Life-subsection 3(g). If included in the process waste stream for waste treatment purposes these two waste streams may seriously interfere with the efficacy of the proposed biological treatment.

4. The Area A wastewater-treatment program relies exclusively upon completion and adequate performance of the aerated lagoon (i.e., Phase II). The full-scale lagoon is scheduled for operation by February 1976. In the interim, process wastes will be discharged without treatment to the South Fork of the Holston River, and projects completed prior to this data (e.g., the tank-farm dike project and collection of boiler blowdown and steam-plant wastes for treatment) will not be functional as all the wastes are designed to ultimately flow to the lagoon.

5. Treatment performance criteria used for the design of the aerated lagoon system are not expected to meet APSA Guidelines or Water Quality Standards Requirements. The system, as described, is incompatible with best practicable control technology. Design criteria were based upon USAEHA derived waste loads which were found considerably lower than the EPA 1972 survey loads. Consequently, expected treatment performance may be greatly altered. Questions are also raised on the applicability of biological treatment to the HAAP wastes. Modification of the criteria, or even the concept itself, could be necessary.

6. A significant air pollution problem exists in Area A. Measures are presently underway to alleviate some of these air pollution emissions.

## D. HOLSTON ARMY AMMUNITION PLANT-AREA B

1. At Area B, the total discharge to the River was 84.4 mgd, containing a net BOD of about 10,000 lb/day. The applicability of the BOD test to some of these waste streams, which may contain nondegradable or even toxic materials, is questionable.

2. In the EPA survey, only about 100 lb of ammonia/day are discharged in the wastewater effluent. Other surveys showed up to almost 2,500 lb/day in the effluent streams. Almost 2,500 lb of the nitrate and nitrite ion/day are discharged into the Holston River.

3. Waste treatment facilities designed by CERL and based on standards of the State of Tennessee were not designed in accordance with the best practicable control technology currently available.

4. All solids removed in the water treatment facility and from steam production are sent untreated to the river.

5. A significant air pollution problem exists in Area B. Measures are presently underway to alleviate some of these air pollution emissions.

6. Static bioassay studies on Streams 29 and 30 after mixing but before entering the river has a 96 hr $TL_m$ value of 23 percent. The combined flow was 16.72 mgd. A factor of 1/20 was used to obtain a river flow that would dilute this so that there would be no long-term impact on aquatic life. A bioassay on stream 31 (at 2.3 mgd) showed a 96 hr $TL_m$ of 23 percent. Similar calculations were performed on this flow. The summation of the two bioassay calculations indicated that a minimum flow of 2,600 cfs would have to be maintained in the river. This figure does not include dilution water that would be necessary to protect the aquatic life from discharges at Area A, Tennessee Eastman Company, or other sources in the area.

## E. MEAD PAPERS

Mead Papers, an integrated Kraft Mill, discharges approximately 17.5 mgd of process wastes containing 21,550 lb of BOD (39.9 lb/ton of product) 31,500 lb of suspended solids (68.5 lb/ton), and 450 lb of TKN to the South Fork of the Holston River. The lagoon system under construction was designed on the basis of meeting an effluent limit of 6,000 lb/day BOD. The present system might not meet requirements for best practicable treatment currently available or water-quality standards requirements. The 1969 study determined that in order to maintain a minimum DO concentration of 3.0 mg/l in the Holston River, the BOD load must not exceed 2,000 lb/day (4.4 lb/ton of product). To meet the existing standard of 5.0 mg/l DO, the BOD in the effluent should not exceed 1,100 lb/day (2.4 lb/ton).

## F. KINGSPORT MUNICIPAL WASTEWATER TREATMENT PLANT

The Kingsport Wastewater Treatment Plant was not sampled because of hydraulic overloading due to the combined sewer flow. The plant bypassed raw sewage and storm water run-off to the South Fork of the Holston River during the period 10 through 14 December 1972.

Plant records indicate that on an annual basis (November 1971 to November 1972), the BOD and suspended solids are reduced by 70 percent and 74 percent, respectively, during normal operating conditions. The effluent contained an average of 57 mg/l (3,130 lb/day) BOD and 36 mg/l (2,190 lb/day) suspended solids, levels which do not meet the requirements for secondary treatment that have been proposed pursuant to the 1972 Amendments to the Federal Water Pollution Control Act. (EPA proposes to limit BOD and SS in the effluent to a monthly average of 30 mg/l and a weekly average of 45 mg/l, or 85 percent overall reduction, whichever produces better quality.) This level of treatment is beyond the present capability of the plant. In addition, the 1969 survey reccommended that the effluent from the Kingsport Wastewater Treatment Plant not exceed 900 lb/day BOD (92 percent removal) to ensure that a minimum of 3.0 mg/l of DO is maintained in the Holston River and in the South Fork of the Holston River. To maintain the official standard of 5 mg/l minimum DO, the effluent should not exceed 500 lb BOD/day (95.5 percent removal).

In the interim until adequate facilities are constructed, some improvement in treatment could be realized by changing the method of recirculation to the trickling filter and by enforcement of the City Industrial Waste Ordinance.

## G. HOLLISTON MILLS

Holliston Mills discharges cooling water containing a BOD and suspended solids load of 30 lb/day and 94 lb/day, respectively. The average flow, 0.28 mgd, was considerably less than the 0.83 mgd reported by the company. While the level here of BOD remained essentially the same as in the raw intake water, increases in the concentrations from background levels of suspended solids (19 mg/l to 40 mg/l), TKN (0.7 mg/l to 1.4 mg/l), total phosphorus (0.2 mg/l to 1.2 mg/l), and sulfate (26.5 mg/l to 66 mg/l) indicated that the water was being contaminated by process water.

Process wastewater is treated prior to discharge. The influent flow to the wastewater lagoon averaged 0.7 mgd and the effluent flow averaged 0.6 mgd, thus demonstrating that excessive seepage from the lagoon was occurring. The suspended solids and sulfates in the polishing lagoon influent were reduced by 20 percent and 41 percent, respectively. However, all other pollutant concentrations increased or remained essentially the same in the lagoon before discharge. The treatment system was not performing efficiently.

The effluent from the lagoon contained a total load of 1,940 lb BOD/day, 200 lb suspended solids/day, and 221 lb sulfide/day. The EPA interim Effluent Guidelines limit the discharges of BOD and suspended solids to 700 lb/day each and sulfide to 7 lb/day. However, the 1969 FWQA study concluded that in order to maintain a minimum DO concentration of 3.0 mg/l in the Holston River, the maximum BOD discharge from Holliston Mills should not exceed 260 lb/day. To maintain a minimum DO concentration of 5.0 mg/l, it is estimated that the maximum BOD discharge shall not be greater than 150 lb/day.

## H. ASG INDUSTRIES, INC.

ASG Industries, Inc. discharged untreated wastewater and cooling water (1.2 mgd) and treated wastewater (0.52 mgd) to the South Fork of the Holston River. The average daily loads from these two discharges contained 4,060 lb suspended solids and 179 lb COD. The oil and grease in the cooling water stream ranged from 4 to 7 mg/l indicating contamination. These loads are greatly in excess of those recommended in the EPA interim Effluent Guidelines which, for a plant of this type, limit the loads to 16.6 lb/day each of suspended solids and COD.

Additional treatment is necessary at ASG to meet the effluent guidelines for suspended solids and COD. All wastewaters need to be segregated from uncontaminated cooling waters, and conservation and water re-use must be practiced if the limits are to be met. Improved coagulation methods will also aid in meeting the guidelines.

## I. PENN-DIXIE CEMENT CORPORATION

The Penn-Dixie Cement Corporation discharged a total of 0.78 mgd wastewater to the South Fork of the Holston River through two outfalls. The wastewater contained a daily average load of 1,800 lb suspended solids or more than 50 times the limit (35 lb/day for a plant of this type) recommended in the EPA interim Effluent Guidelines. Ninety-six percent of this loading came from a supposedly uncontaminated cooling-water discharge for which no permit application had been filed.

To achieve effective pollution control, water re-use and conservation must be practiced; the source of suspended solids in the cooling water stream must be isolated and treated.

## J. J. P. STEVENS

The J. P. Stevens-Borden Plant discharges all wastewater to the Kingsport Municipal Wastewater Treatment Plant. However during the survey wastewater was being diverted to the river because of a blocked interceptor. This condition was subsequently corrected by city personnel.

## III. RECOMMENDATIONS

To enhance and protect the quality of the Holston River and its tributaries the following recommendations are made.

### A. TENNESSEE EASTMAN COMPANY

1. To maintain a minimum concentration of 5.0 mg/1 DO in the Holston River all process wastewater shall be immediately segregated from the once through, non-contact cooling water. The total BOD and TKN discharged in the process wastewaters shall not exceed 3,350 lb/day and 400 lb/day, respectively. These loads are based on requirements necessary to maintain a minimum concentration of 5.0 mg/1 DO in the Holston River. The suspended solids concentration in the process wastewater shall not exceed 30 mg/1 greater than background levels; the total concentration of heavy metals shall not exceed 1.0 mg/1; and the nitrite + nitrate nitrogen concentration shall not exceed 1.0 mg/1. The pH shall be maintained within the range of 6.0 to 9.0 at all times. There shall be no detectable discharge of potentially toxic organic wastes.

A suggested treatment system to meet these effluent limitations could incorporate:

a. Pretreatment measures to protect biological treatment process;

b. Activated sludge;

c. Deep-bed filtration;

d. Carbon adsorption;

e. Denitrification;

2. Pretreatment regulations shall be established for the waste discharged to the Kingsport WWTP requiring the removal of potentially

toxic organic substances and other pollutants to levels that will neither inhibit biological treatment processes nor pass through the systems in concentrations or loads inconsistent with effluent limitations that will be established pursuant to the Federal Water Pollution Control Act Amendments of 1972.

3. All additional effluent requirements established by the State of Tennessee shall be met.

4. A schedule and proposed method of treatment for achieving the necessary pollution abatement shall be provided to EPA, Region IV, by 15 October 1973.

## B. HOLSTON ARMY AMMUNITION PLANT

1. To meet water-quality standards in the Holston River and the requirements of the National Pollution Discharge Elimination System the following effluent limitations are recommended for the Holston Army Ammunition Plant (Areas A & B) located in the vicinity of Kingsport, Tennessee:

a. BOD not to exceed 2,400 lb/day
   Area A-1,000 lb/day
   Area B-1,400 lb/day

b. TKN not to exceed 100 lb/day
   Area A-10 lb/day
   Area B-90 lb/day

c. Heavy metals not to exceed 150 lb/day
   Area A-30 lb/day
   Area B-120 lb/day

d. Phenolics not to exceed 5 lb/day
   Area A-1 lb/day
   Area B-4 lb/day

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NOTE: Effluent limitations a through d refer to net additions to raw intake water.

e. No detectable discharge made of potentially toxic organic wastes

f. SS shall not exceed 30 mg/l in process wastes and background in cooling water. In the process waste, the SS limit shall be 4,600 lb/day.
Area A-1,000 lb/day
Area B-3,600 lb/day

g. Nitrate and nitrite nitrogen shall not exceed 1 mg/l in process wastes and background in cooling water. In the process wastes the nitrate-nitrite shall be limited to 150 lb/day.
Area A-30 lb/day
Area B-120 lb/day

2. The Army Munitions Command shall provide to the Environmental Protection Agency, Region IV, by not later than 15 July 1973, a treatment system and schedule of abatement necessary to meet the effluent limitations established in recommendation number one by 1 July 1977. A suggested treatment system which could meet these limitations is:

a. Separation of process wastes and major uncontaminated cooling water streams to the maximum extent feasible

b. Pretreatment measures to protect the biological treatment process

c. Activated sludge

d. Deep-bed filtration

e. Carbon adsorption

f. Denitrification

3. Sludges, solids, and debris resulting from water treatment process at both Areas A and B shall be dewatered and removed to approved landfill with no discharge to receiving waters.

4. Wastes resulting from discharges in the tar-tank storage area shall be completely contained and not discharged to receiving waters nor

included in any process-waste streams that discharge to the waste treatment system. There shall be no discharge of this coal tar waste to receiving waters.

5. For the tank-farm- and chemical-storage areas HAAP shall develop a strong spill prevention, containment, and countermeasure program as soon as possible. Such a program and associated plan of action shall, as a bare minimum, incorporate preventive maintenance and inspection; adequate capacity diking or curbs shall be constructed around all tanks or groups of tanks so as to prevent a) chemicals leaking or spilling from the tanks and b) any storm water contaminated with chemicals from entering a receiving watercourse. In no event shall spills, be allowed to enter sanitary, process, or cooling-water sewers. Complete containment and separate recovery or treatment of spills, leaks, and associated drainage are recommended.

6. All additional effluent requirements established by the State of Tennessee shall be met.

C. MEAD PAPERS

1. To maintain a minimum concentration of 5.0 mg/l DO in the Holston River the BOD in the effluent shall not exceed 1,100 lb/day. The suspended solids shall not exceed 1,100 lb/day above background levels; the pH shall be within the range of 6.0 to 9.0 at all times.

2. All additional effluent regulations established by the State of Tennessee shall be met.

3. The aerated lagoon under construction shall receive all process wastes. There shall be no discharge of wastes from the water-treatment plant without adequate treatment.

4. The effluent structure from the black liquor pond shall be sealed, and all storm water diverted around the lagoon so that the contents of the pond are not released.

5. A schedule and proposed method of treatment for achieving the necessary pollution abatement shall be provided to EPA, Region IV, by 15 October 1973.

D. KINGSPORT WASTEWATER TREATMENT PLANT

City officials shall be formally advised that:

1. To maintain a minimum concentration of 5.0 mg/l DO in the Holston River, the BOD in the effluent shall not exceed 500 lb/day. The suspended solids shall not exceed 500 lb/day. All additional effluent requirements established by the State of Tennessee shall be met.

2. The fecal-coliform bacterial density in the effluent shall not exceed 200/100 ml as a monthly average and 400/100 ml as a weekly average.

3. The industrial waste ordinance for the city shall be modified to meet the requirements for pretreatment when published in accordance with the Federal Water Pollution Control Act Amendments of 1972.

4. Corrective measures shall be taken to preclude the by-passing of untreated wastes from the plant or within the sewerage system due to excessive combined sewer flows. A sewer maintenance program shall be developed to routinely inspect, clean, and repair sewers and thus, eliminate direct by-passing resulting from plugged lines, etc.

5. A schedule and proposed method of treatment for achieving the necessary pollution abatement shall be provided EPA, Region IV, by 15 October 1973.

### E. HOLLISTON MILLS

1. To maintain a minimum concentration of 5.0 mg/l DO in the Holston River, the BOD in the effluent shall not exceed 150 lb/day. The suspended solids shall not exceed 150 lb/day above background levels. Chromium and phenolics shall each not exceed 3.5 lb/day, and sulfide shall not exceed 7.0 lb/day.

2. All additional effluent requirements established by the State of Tennessee shall be met.

3. The cooling-water and process-wastewater streams shall be segregated.

4. Holliston Mills, Inc., in its manufacturing processes, incorporate more in-plant control measures, re-use of cooling water, and improved housekeeping in order to prevent solvents, sizing agents, dyes, pigments, plastics and other contaminants from entering the wastewater system.

5. A schedule and proposed method of treatment for achieving the necessary pollution abatement shall be provided EPA, Region IV, by 15 October 1973.

### F. ASG INDUSTRIES

1. To meet the EPA interim Effluent Guidelines, based on the best practicable control technology currently available, the total wasteload discharged shall not exceed the following limits:

| Parameter | lb/day |
|---|---|
| Suspended Solids | 16.6 |
| COD | 16.6 |

| | |
|---|---|
| Hexane Extractables (oil and grease) | 2.1 |
| Total Phosphorus | 2.1 |

2. All additional effluent requirements established by the State of Tennessee shall be met.

3. A schedule and proposed method of treatment for achieving the necessary pollution abatement shall be provided EPA, Region IV, by 15 October 1973.

## G. PENN-DIXIE CEMENT CORPORATION

1. To meet the EPA interim Effluent Guidelines, based on the best practicable control technology currently available, the total COD and suspended solids discharged shall each not exceed 35 lb/day. Additional effluent requirements established by the State of Tennessee shall be met.

2. A schedule and proposed method of treatment for achieving the necessary pollution abatement shall be provided EPA, Region IV, by 15 October 1973.

## H. GENERAL

1. The permits issued to all waste dischargers in the Kingsport area shall include requirements for a monitoring program of sufficient detail to ensure compliance with the established effluent limitations and protection of the receiving waters.

2. Effluent limits for parameters shall as color, fecal coliforms, oil and grease, etc, shall be set where necessary in order to protect the receiving-water quality.

# IV. STUDY AREA

## A. GENERAL DESCRIPTION

The study area [Figure IV-1, inside back cover] lies within the Holston River Basin in the rugged hill country of Northeastern Tennessee and includes portions of Sullivan and Washington Counties. The Holston River is formed by the confluence of the South and North Forks of the Holston River, at Kingsport.

Kingsport, Johnson City, and Bristol, major cities in eastern Tennessee, form the "Tri-Cities" metropolitan area. Also, Bristol, Virginia, is a major city in the Holston River Basin.

Kingsport (population, 30,800[2]), located in Sullivan County, is the only city that is within the study area. Kingsport is the most industrialized of the three cities and provides jobs for more than 34,000 people.[3] Since 1960, the city has grown at an annual rate that exceeds 17 percent. The majority of the development has been along the South Fork of the Holston River.

## B. ECONOMICS

A detailed study[4] of the economic growth in eastern Tennessee and western Virginia reported that manufacturing is the major industry, employing 73,200 persons. Chemicals and allied products, apparel, and textile products are the leading industries. The pulp and paper industry is projected as having the major growth potential. Employment in the region is anticipated to increase from its present rate of 31 per 100 population to 36 per 100 population by the year 2020.[3]

## C. HYDROLOGY

The Tennessee Valley Authority (TVA) has constructed a series of impoundments upstream of Kingsport on the South Fork of the Holston River and its tributaries to control flooding and generate hydroelectric power. The flow in the North Fork is unregulated. The 20 year,* three-day low flow in the North Fork, recorded at Gate City, Virginia, is 46 cfs, (or 58 cfs, for 7-day, 10-yr flow) and the mean daily discharge is 851 cfs. The TVA is required to release water from Fort Patrick Henry Dam to maintain a minimum daily flow of 450 cfs in the South Fork of the Holston River. However, the Tennessee Eastman Company requires a minimum daily stream flow of 750 cfs for process and cooling water. The company purchases the additional water required from the TVA.

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* The Tennessee Water Quality Criteria are applied on the basis of two definitions of minimum flow: (1) unregulated streams--3-day minimum, 20-year recurrence interval, and (2) regulated streams--instantaneous minimum.

# V. APPLICABLE WATER QUALITY STANDARDS AND REGULATIONS

## A. WATER QUALITY STANDARDS

The Holston River, an interstate stream, and the South Fork of the Holston River are used for public water supply, industrial water supply, recreation, hydroelectric power, agricultural purposes, and receipt of treated wastes. Within the study area, all the rivers and streams investigated, with the exception of Hales Branch (not classified) and North Fork are classified as suitable for "Fish and Aquatic Life." In addition, the Holston River downstream (RM 131.5) from Kingsport is classified as "Domestic Raw Water Supply." [The Tennessee Water Quality Criteria are contained in Appendix A.]

The criteria and standards require that all wastes in the Kingsport area [Table V-1] will receive the best practicable treatment (secondary or equivalent) or control according to the policy and procedure of the Tennessee Water Quality Control Board. A degree of treatment greater than secondary, when necessary to protect the water uses, will be required for selected sewage and waste discharges.

Specific standards applicable to this survey include:

1. Dissolved Oxygen--The dissolved oxygen shall be maintained at 5.0 mg/1 except in limited sections of the stream receiving treated effluent. In these limited sections,* a minimum of 3.0 mg/1 dissolved oxygen shall be allowed. [These limited sections are mixing zones which refer to that section of the

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* The EPA has requested that Tennessee upgrade Water Quality Criteria for these sections to 5.0 mg/1 DO and to establish a fecal coliform criteria of 2,000/100 ml for water classified for fish and aquatic life.

## TABLE V-1

### STATE OF TENNESSEE
### EFFLUENT STANDARDS[a] FOR WASTE DISCHARGES
### IN THE KINGSPORT AREA

| Source | Parameter | Waste Load lb/day | Percent Treatment | Effluent Requirements lb/day |
|---|---|---|---|---|
| Tennessee Eastman Company | BOD | 75,000[b] | 95.54[c] | 3,350 |
| | TKN | 16,120[d] | 97.5 | 400 |
| | TN | 16,120[d] | | 3,310[e] |
| | $NH_3$ | 10,780[f] | | 400 |
| | $NO_3$ | | | 2,910[e] |
| Mead Corporation | BOD | 25,000[b] | 95.54[c] | 1,100 |
| | TKN | 60[d] | | |
| | TN | 60[d] | | |
| | $NH_3$ | 0 | | |
| | $NO_3$ | | | |
| Kingsport WWTP | BOD | 11,250[b] | 95.54[c] | 500 |
| | TKN | 160[d] | | |
| | TN | 180[d] | | |
| | $NH_3$ | | | 133[g] |
| | $NO_3$ | 20 | | |
| Holston Army Ammunition Plant Area A | BOD | 23,480[b] | 95.54[c] | 1,050 |
| | TKN | 10[d] | | |
| | TN | 10[d] | | |
| | $NH_3$ | 10[f] | | |
| | $NO_3$ | | | |
| Totals for South Fork | BOD | 134,730[b] | Totals | 6,000[h] |
| | TKN | 16,350[b] | | 437[h] |
| | TN | | | |
| | $NH_3$ | 10,900 | | 2,133[i] |
| | $NO_3$ | | | |
| Holston Army Ammunition Plant Area B | BOD | 32,220 | 95.54[j] | 1,430[j] |
| | TKN | 3,045 | 97.5 | 76[j] |
| | TN | 5,515 | | 620[e] |
| | $NH_3$ | 2,830 | | 76 |
| | $NO_3$ | 2,460 | | 556 |

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a/ These effluent standards are for use in temporary state permits and have been confirmed by letter from the State of Tennessee [Appendix A] to the individual companies.

b/ Water Quality and Waste Treatment Requirements on the Upper Holston River, EPA, Region IV, 1972, Table 4, Page 23.

c/ Calculated percentage of treatment required in the Kingsport Area to achieve 6,000 pounds total BOD discharge. Based on raw waste loads from the EPA report of 1972.

d/ Water Quality and Waste Treatment Requirements on the Upper Holston River, EPA, Region IV, 1972; Appendix B, Waste Discharges, Upper Holston River Nitrogenous Material, Page B-2.

e/ Based on 1.0 mg/l (4,000 lb/day) increase in the $NO_3$ level in the Holston River below all waste sources including Holston Army Ammunition Plant, Area B. This Figure is based on maintaining a total phosphorus level of 0.1 mg/l in the Holston River below all waste sources. This ratio of phosphorus to nitrogen is to be maintained below 1/10 in the river to attempt to control the aquatic vegetation. Limits for Eastman and Mead were proportioned based on their present TN levels. Total TN levels at present for all discharges was calculated to be 19,395 pounds per day.

f/ EPA, 1972 report, Appendix B, Waste Discharges, Upper Holston River. Effluent data.

g/ Based on a plant flow of 10 mgd (6.2 mgd present and 3.8 mgd expansion allowed) and 1.6 mg/l $NH_3$-N in the effluent.

h/ "Treatment Levels Required for Kingsport Waste Discharges," VA preliminary draft report. Calculated based on a new BOD load in the Kingsport Area of 237,500 pounds and a treatment requirement of 97.5 percent (see Figure 3, 760 cfs, 6 mg/l DO) and a TKN of 17,500 and a treatment of 97.5 percent.

i/ Estimated based on 760 cubic feet per second stream flow, maximum stream concentration of 0.5 based on the domestic raw water supply classification below Church Hill.

j/ Based on a treat level the same as that of Eastman.

flowing stream or impounded waters necessary for effluents to become dispersed. The mixing zone necessary in each particular case shall be defined by the Tennessee Water Quality Control Board.] The dissolved oxygen content shall be measured at mid-depth in waters having a total depth of ten (10) feet or less and at a depth of five (5) feet in waters having a total depth of greater than ten (10) feet. Minimum dissolved oxygen content of 6.0 mg/l shall be maintained in recognized trout streams.

2. pH--The pH value shall lie within the range of 6.5 to 8.5 and shall not fluctuate more than 1.0 unit in this range over a period of 24 hours.
3. Solids, Floating Materials and Deposits--There shall be no distinctly visible solids, scum, foam, oily slick, or the formation of slimes, bottom deposits or sludge banks of such size or character that may be detrimental to fish and aquatic life.
4. Turbidity or Color--There shall be no turbidity or color added in such amounts or of such character that will materially affect fish and aquatic life.
5. Temperature--The maximum water temperature change shall not exceed 3°C relative to an upstream control point. The temperature of the water shall not exceed 30.5°C and the maximum rate of change shall not exceed 2°C per hour. The temperature of recognized trout waters shall not exceed 20°C. There shall be no abnormal temperature changes that may affect aquatic life unless caused by natural conditions. The temperature

of impoundments where stratification occurs will be measured at a depth of 5 feet, or mid-depth whichever is less, and the temperature in flowing streams shall be measured at mid-depth.

6. Taste or Odor--There shall be no substances added that will impart unpalatable flavor to fish or result in noticeable offensive odors in the vicinity of the water or otherwise interfere with fish or aquatic life.
7. Toxic Substances--There shall be no substances added to the waters that will produce toxic conditions that affect fish or aquatic life.
8. Other Pollutants--Other pollutants shall not be added to the waters that will be detrimental to fish or aquatic life.

## B. FEDERAL WATER POLLUTION CONTROL ACT AMENDMENTS OF 1972

Under the Federal Water Pollution Control Act Amendments of 1972 (FWPCAA), existing water quality standards for interstate waters are preserved. In addition, the Act requires the preparation of water quality standards applicable to intrastate waters. The existing mechanism for State establishment, Federal review and promulgation and review of water quality standards is continued.

Hales Branch, a tributary to the South Fork of the Holston River, falls within this intrastate category; water quality standards must therefore be established.

The Act also provides that all point sources of pollution other than publicly owned treatment works, which discharge directly into the

Nation's waters are required to achieve, not later than July 1, 1977, effluent limitations which shall require the application of the "best practicable control technology currently available." The same point sources must achieve effluent limitations which shall require the application of the "best available technology economically achievable" by July 1983. Point sources discharging into publicly owned treatment works must comply with pretreatment standards as prescribed by the EPA. EPA will also limit the discharge of pollutants determined to be toxic and where appropriate may require an absolute prohibition of the discharge of such toxic pollutants.

Publicly owned treatment works must meet effluent limitations by July 1, 1977 which are based on "secondary treatment" as defined by EPA. By July 1, 1983, public plants must meet "best practicable waste treatment technology."

The established effluent limitations for each individual point source will be applied as conditions of permits to be issued under the National Pollutant Discharge Elimination System as established by the Act.

In cases where the prescribed effluent limitations will not achieve a level of water quality consistent with water quality standards and suitable for swimming and sustaining a balanced population of fish, shellfish and wildlife, EPA may impose more stringent effluent limitations as may be necessary to achieve that goal.

## VI. STREAM SURVEY

### A. 1969 FWQA SURVEY

An extensive stream survey conducted in July 1969 demonstrated that waste discharges in the Kingsport, Tennessee, area seriously affected the water quality of the South Fork of the Holston River and the Holston River. At the time of that survey approximately 137,500 lb BOD were discharged from the HAAP, Mead Papers, TEC, Holliston Mills and the Kingsport Municipal Wastewater Treatment Plant. Discharges of total Kjeldahl nitrogen, primarily from TEC and HAAP, amounted to almost 19,500 lb/day, which theoretically represent an ultimate oxygen demand of about 84,000 lb.

Extensive sludge beds covered an estimated 25 percent of the bottom area of the Holston River from the confluence of the North and South Forks of the Holston River (RM 142.15) downstream for about 23 miles.

The 1969 study revealed that releases from Fort Patrick Henry Dam had a marked affect upon the hydrological regimen of both the South Fork of the Holston River and the Holston River, especially during off-peak, power-generating periods when releases would be reduced to a daily average of 750 cfs (3,000 cfs for one hr, no release for three hr). When this coincides with low flows in the North Fork of the Holston River, the flow in the Holston River could be reduced to about 800 cfs. Because releases during these periods are made primarily from the hypolimnion of the reservoir, the dissolved-oxygen concentrations are below the saturation level.

During the 1969 survey the flows in the South and North Forks of the Holston River averaged 840 and 660 cfs, respectively.

The dissolved-oxygen levels fell below the established standards

(5.0 mg/l) at stations within the reach, from RM 142.15/1.2 downstream to RM 125.30.

Temperature in the South Fork of the Holston River increased from averages of 15.5°C upstream of TEC discharges (RM 142.15/5.6) to greater than 26.9°C downstream of the HAAP A discharges. This increase violated the Tennessee Water Quality Standards for temperature which restricts temperature changes to 3°C relative to an upstream control point. It was concluded that cooling devices must be installed at TEC and HAAP A to prohibit these increases.

Further, the results of the 1969 survey recommended that the BOD discharged be reduced by 92 percent from the five sources mentioned earlier. Moreover, the total Kjeldahl-nitrogen discharges from TEC and HAAP waste sources were also to be reduced by 92 percent. The recommended limits from each source, based on the 1969 survey results, are shown in Table VI-1.

TABLE VI-1

ESTIMATED WASTE LOAD LIMITS BASED ON 1969 SURVEY

| | BOD lb/day | TKN lb/day |
|---|---|---|
| Tennessee Eastman Corp. | 6,000 | 1,600 |
| Mead Papers | 2,000 | |
| Kingsport WWTP | 900 | |
| HAAP-Area A | 1,900 | |
| HAAP-Area B | 2,600 | 350 |
| Holliston Mills, Inc. | 260 | |

## B. 1972 EPA SURVEY

A limited stream survey was conducted during the period 4 through 7 December 1972 in order to ascertain the changes in receiving water quality as a result of waste discharges. The four sampling stations [Figure IV-1] selected were as follows:

| Station Number | Station Description |
|---|---|
| 53 | North Fork of the Holston River at Netherland Inn Road (RM 142.15/0.2) |
| 54 | South Fork of the Holston River at Tennessee Highway 93 Bridge (RM 142.15/5.6) |
| 55 | South Fork of the Holston River at Ridgefields Bridge (RM 142.15/1.2) |
| 56 | Holston River at Church Hill Bridge (RM 131.5) |

Samples collected at the stations were analyzed for the following parameters: nitrogen series, total phosphorus, organic chemicals, and heavy metals (Hg, Cu, Cr, Fe, Mn, Zn, Pb, and Sn). Because of the differences in the climatic and hydrologic conditions, in 1972, from those of the 1969 study period, dissolved oxygen and BOD analyses were not performed. The samples from Stations 54 and 55 were also analyzed for phenolic materials. At all locations samples were collected at the third points near the surface. These grab samples were then composited on an equal-volume basis. Each time a sample was collected field measurements were made for pH conductivity and temperature [Table VI-2].

During the survey average daily flows in the Holston River were estimated to be from 3,500 to 4,600 cfs [Table VI-3]. Releases from Fort Patrick Henry Dam varied from zero to 7,500 cfs because of the power

### TABLE VI-2

### SUMMARY OF FIELD MEASUREMENTS AND SELECTED CHEMICAL DATA
STREAM SURVEY
KINGSPORT, TENNESSEE
4-6 DECEMBER 1972

| Station Number | 53 | | 54 | | 55 | | 56 | |
|---|---|---|---|---|---|---|---|---|
| Station Description[a] | North Fork Holston River (RM 142.15/0.20) | | So. Fork Holston River at Hwy 93 Bridge (RM 142.15/5.6) | | So. Fork Holston River at Ridgefields Bridge (RM 142.15/1.2) | | Holston River at Church Hill Bridge (RM 131.5) | |
| Parameter[b] | Range | Average | Range | Average | Range | Average | Range | Average |
| pH (standard units) | 8.0-9.0 | | 7.3-7.9 | | 7.0-7.6 | | 7.2-7.9 | |
| Temperature (°C) | 4.5-9.0 | | 8.5-10.5 | | 9.5-18.0 | | 9.0-12.0 | |
| Conductivity (μmhos/cm) | 280-460 | | 160-270 | | 200-310 | | 210-380 | |
| TOC | 1.0-2.0 | 1.4 | 1.0-2.0 | 1.6 | 4.0-11.0 | 6.2 | 4.0-7.0 0 | 5.6 |
| Total Kjeldahl Nitrogen-N | <0.5-0.5 | <0.5 | <0.5-0.5 | <0.5 | 0.6-0.9 | 0.8 | 0.6-1.0 | 0.8 |
| $NH_3$-N | N.D.[c] | | N.D. | | <0.5-0.5 | <0.5 | N.D. | |
| $NO_2$ + $NO_3$-N | 0.4-10 | | 0.9[d] | 0.9 | 0.9-3.2 | 1.4 | 0.9 | |
| Total Phosphorus-P | 0.05-0.22 | 0.11 | 0.07-0.18 | 0.11 | 0.12-0.58 | 0.30 | 0.05-0.21 | 0.13 |
| Phenols | | | <0.01[d] | <0.01 | <0.01-0.01 | <0.01 | | |
| Mercury, μg/l | <0.1-0.1 | <0.1 | <0.1-0.1 | <0.1 | <0.1-0.1 | <0.1 | <0.1-0.1 | <0.1 |
| Copper | <0.01-0.02 | 0.1 | 0.01-0.03 | 0.02 | <0.01-0.03 | <0.01 | <0.01-0.02 | <0.01 |
| Chromium | N.D. | | N.D. | | N.D. | | N.D. | |
| Iron | <0.1-0.2 | 0.1 | <0.1-0.2 | 0.1 | 0.2-0.3 | 0.2 | <0.1-0.3 | 0.2 |
| Manganese | <0.01-0.02 | <0.01 | 0.03-0.04 | 0.03 | 0.53-0.85 | 0.69 | 0.21-0.40 | 0.33 |
| Cadmium | N.D. | | N.D. | | N.D. | | N.D. | |
| Zinc | <0.01-0.02 | 0.01 | 0.04-0.05 | 0.04 | 0.05-0.09 | 0.07 | | |
| Lead | N.D. | | N.D. | | N.D. | | N.D. | |
| Tin | N.D. | | N.D. | | N.D. | | | |

[a] See Appendix C for Station Description.
[b] All values reported as mg/l, except where otherwise specified.
[c] N.D. - None Detected.
[d] All values are the same.

## TABLE VI-3

### AVERAGE DAILY FLOWS (cfs)
### AT SELECTED LOCATIONS DURING 1972 STREAM SURVEY
### KINGSPORT, TENNESSEE

| Gaging Station | 4 December | 5 December | 6 December |
|---|---|---|---|
| North Fork of the Holston River at Gate City, Tennessee (RM 142.15/8.8) | 900 | 868 | 873 |
| South Fork of the[a] Holston River (Releases from Fort Patrick Henry Dam) (RM 142.15/8.2) | 3,173 | 2,543 | 3,666 |
| Holston River[b] at Church Hill Bridge (RM 131.5) | 4,100 | 3,500 | 4,600 |

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[a] Flow releases from Ft. Patrick Henry Dam vary from hour to hour and ranged from zero to 7,500 cfs during the three-day survey.

[b] The average daily flows in the Holston River at the Church Hill Bridge were estimated from the average flows in the North and South Forks of the Holston River plus some allowances for minor inputs.

generation demands. This caused a wide range in the stages of the South Fork of the Holston River. Stream samples were collected under varying flow conditions.

Discharges to the South Fork of the Holston River made during December 1972 had average daily waste loads of approximately 95,000 lb of BOD; 54,000 lb TOC; 11,000 lb total Kjeldahl nitrogen; and 2,600 lb of nitrate-nitrogen. These include measured loads from TEC; HAAP A & B; ASG Industries, Penn-Dixie Cement Corporation; and Mead Papers; and the estimated waste loads from the Kingsport Municipal Wastewater Treatment Plant. Tennessee Eastman, HAAP, and Mead Papers contributed 95 percent of these waste loads on a BOD basis. The waste loads from the Kingsport Municipal Wastewater Treatment Plant were not measured. However, from a review of operating records, the plant discharge to the South Fork of the Holston River had an average BOD of 3,100 lb/day. The BOD and total Kjeldahl nitrogen loads discharged greatly exceed the loads recommended as a result of the 1969 survey [Table VI-1].

Discharges from HAAP 'B' and Holliston Mills contributed to the Holston River a BOD of approximately 16,500 lb/day, 7,000 lb/day TOC, 1,000 lb/day total Kjeldahl nitrogen, and 2,400 lb/day nitrate-nitrogen, the latter waste load discharged totally by HAAP B.

Heavy-metals analyses of water samples disclosed a significant increase (more than 20 times) in manganese concentrations from the Station-54 location to Station 55. The increase is attributed to the Tennessee Eastman Company which was discharging wastewater containing about 9,500 lb/day of manganese. At Station 56 (RM 131.5) the concentrations of manganese ranged from 0.21 to 0.40 mg/l well above the Public Health Service Drinking Water standards recommended limit (0.05 mg/l). (At Station 56 the Holston River is classified as a suitable public-water supply for domestic use.) Violations of the standards for domestic water supply occurred [Appendix A, Domestic Water Supply Item 1K-other Pollutants]. Manganese concentrations in the sediment were significant at Stations 53 (844 mg/kg) and 54 (9,800 mg/kg) and increased by one order of magnitude downstream from all waste sources in the Kingsport area (Station 56). The sediments Table VI-4 also revealed exceedingly high concentrations of iron (7,373 - 20,200 mg/kg) at all of the stations.

Water samples collected on 6 and 13 December 1972 for organic chemical analysis disclosed that organic pollutants [Table VI-5] were present only at Station 56, downstream from all waste discharges. A sediment sample taken from the Holston River at Church Hill Bridge (RM 131.5) contained aliphatic hydrocarbons, phenolics, fatty acid esters, and phthalates. Di-*n*-butyl phthalate was present in concentrations of 2 mg/kg, and the concentration of an unidentified *n*-alkane was 11 mg/kg. These materials are not highly toxic, but the phthalates are suspected of producing mutations in some species of fish.

A comparison of the 1969 and 1972 survey data (specifically, average concentrations of total Kjeldahl nitrogen, $NO_2 + NO_3$-N, and Total P) is available [Table VI-6]. Nutrients presently in the river are at levels sufficient for the creation of water-quality problems such as those observed during the 1969 survey.

# TABLE VI-4

## HEAVY METALS IN STREAM SEDIMENTS
## KINGSPORT, TENNESSEE
## 5-7 DECEMBER 1972

| Station Number | Station Description | Date Collected | mg/kg of Dry Sample | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | Mercury | Copper | Cadmium | Iron | Manganese | Lead | Chromium |
| 53 | North Fork of Holston River at Netherland Inn Road (RM 142.15/0.2) | 12/7 | 0.3 | 19.0 | 3.0 | 20,200 | 844 | 152 | 37 |
| 54 | South Fork of Holston River at Tennessee Hwy 93 Bridge (RM 142.15/5.6) | 12/5 | <0.1 | 29.0 | <1.0 | 9,800 | 330 | 29 | 22 |
| 56 | Holston River at Church Hill Bridge (RM 131.5) | 12/5[a] | 6.6 | 93.0 | 2.0 | 7,373 | 2,136 | 30 | 56 |
| | | 12/5[a] | 6.9 | 94.0 | 2.0 | 8,100 | 2,080 | 30 | 55 |
| | | 12/6[b] | 3.8 | 354 | 2.0 | 22,725 | 1,545 | 91 | 117 |

a/ Sample taken on left side of River.
b/ Sample taken on right side of River.

## TABLE VI-5

## ORGANIC ANALYSIS OF WATER SAMPLES
## FROM SELECTED STREAM LOCATIONS
## KINGSPORT, TENNESSEE
## 6 AND 13 DECEMBER 1972

| Station Number | Station Description | Water Analysis |
|---|---|---|
| 53 | North Fork of Holston River at Netherland Inn Road (RM 142.15/0.2) | None detected |
| 54 | South Fork of Holston River at Tennessee Hwy 93 Bridge (RM 142.15/5.6) | None detected |
| 55 | South Fork of Holston River at Ridgefields Bridge (RM 142.15/1.2) | None detected |
| 56 | Holston River at Church Hill Bridge (RM 131.5) | A chlorinated aromatic compound tentatively identified as a chlorophenylbenzyl ether is present at about 2 ppm. There are other organic compounds present in trace amounts (less than 0.1 ppm). |

## TABLE VI-6

## COMPARISON OF NUTRIENT DATA
## HOLSTON RIVER, KINGSPORT, TENNESSEE

| Station Number | Year | Concentration, mg/l | | |
|---|---|---|---|---|
| | | TKN | $NO_2$-$NO_3$ | Total-P |
| 53 | 1969 | 0.39 | 1.01 | 0.03 |
| | 1972 | <0.5 | 0.4 | 0.11 |
| 54 | 1969 | 0.39 | 1.25 | 0.03 |
| | 1972 | <0.5 | 0.9 | 0.11 |
| 55 | 1969 | 3.02 | 0.86 | 0.27 |
| | 1972 | 0.8 | 1.4 | 0.30 |
| 56 | 1969 | 2.17 | 0.89 | 0.07 |
| | 1972 | 0.8 | 0.9 | 0.13 |

During the 1972 study the maximum temperature increase recorded between stations 54 (RM 142.15/5.6) and 55 (RM 142.15/1.2) was 9°C. For most of the study period, the increases recorded were 4°C or less although the temperatures of the main waste discharges ranged from 18-25°C. For example, Hale's Branch which carries TEC cooling waters (311 mgd average) varied from 22.5-25°C. As mentioned earlier flow conditions were significantly different than those which occurred during the 1969 study, thus the effects of the heated discharges was diminished. However, the 1969 study conclusion stressing the need for cooling devices at TEC and HAAP A is obviously still very valid. Violations of the stream temperature standards will continue to occur until the temperature of the discharges is reduced.

# VII. WASTE-SOURCE EVALUATION AND TREATMENT NEEDS

## A. GENERAL

The major waste sources discharging to the South Fork of the Holston River downstream from Fort Patrick Henry Dam (RM 142.15/8.2) and the Holston River in the vicinity of Kingsport, Tennessee [Figure IV-1] were evaluated during the period 28 November through 15 December 1972. These investigations were made (1) to determine the quality and quantity of wastes discharged to the Holston River and its tributaries, (2) to provide information for establishing effluent limitations, and (3) to evaluate present pollution control practices. The waste sources evaluated included:

1. ASG Industries, Incorporated
2. Holston Army Ammunition Plant (HAAP)--Areas A and B
3. Holliston Mills, Incorporated
4. J. P. Stevens and Company, Incorporated
5. Kingsport Municipal Wastewater Treatment Plant
6. Mead Papers, a Division of Mead Corporation
7. Penn-Dixie Cement Corporation
8. Tennessee Eastman Company (TEC)

The measured waste loads from the industrial waste sources, together with the estimated discharge from the Kingsport Municipal Wastewater Treatment Plant, have been summarized [Table VII-1]; also included is a summary of the waste loads found during the 1969 FWQA study of the Upper Holston River Basin. From the latter study it was concluded that in order to

## TABLE VII-1
## SUMMARY OF WASTEWATER DISCHARGES
## 1969 AND 1972 SURVEYS
## KINGSPORT, TENNESSEE

| Waste Source | Receiving Water | Number of Outfalls Sampled | Flow mgd | BOD lbs/day | SS lbs/day | TKN lbs/day | $NH_3$-N lbs/day | $NO_3$+$NO_2$-N lbs/day |
|---|---|---|---|---|---|---|---|---|
| 1969 FWQA Region IV Findings[a] | | | | | | | | |
| ASG Industries, Inc. | SFHR[b] | Not sampled | | | | | | |
| HAAP-Area A | SFHR | 3 | 59.5 | 23,480 | 4,100 | 10 | 10 | c/ |
| Area B | HR[d] | 7 | 103 | 32,220 | 4,840 | 3,045 | 2,810 | 2,460 |
| Holliston Mills | HR | 1 | 0.38 | 3,200 | 89 | 30 | c/ | c/ |
| J.P. Stevens & Co., Inc. | SFHR | Not sampled | | | | | | |
| Kingsport Municipal WWTP | SFHR | 1 | 2.4 | 500 | 440 | 160 | 110 | 20 |
| Mead Papers | SFHR | 1 | 9.4 | 11,700 | 11,430 | 60 | c/ | c/ |
| Penn-Dixie Cement Corp. | SFHR | Not sampled | | | | | | |
| TEC | SFHR | 3 | 256 | 69,300 | 7,780 | 16,120 | 10,780 | c/ |
| Total | | | 431 | 140,400 | 28,700 | 19,400 | 13,700 | 2,480 |
| 1972 EPA Findings | | | | | | | | |
| ASG Industries, Inc. | SFHR | 2 | 1.70 | NA[e] | 4,100 | NA | NA | NA |
| HAAP-Area A | SFHR | 8 | 43.3 | 20,300 | 4,060 | c/ | c/ | 419 |
| Area B | HR | 9 | 73.6 | 14,600 | 26,800 | 600 | 106 | 2,352 |
| Holliston Mills | HR | 2 | .890 | 1,970 | 294 | 39 | 14 | c/ |
| J.P. Stevens & Co. Inc. | SFHR | 1 | 1.20 | 620 | 460 | 93 | 36 | c/ |
| Kingsport Municipal WWTP | SFHR | 2 | 6.59[f] | 3,130[f] | 2,190[f] | NA | NA | NA |
| Mead Papers | SFHR | 2 | 17.5 | 21,600 | 31,500 | 451 | 164 | 14 |
| Penn-Dixie Cement Corp. | SFHR | 2 | .770 | NA | 1,810 | NA | NA | NA |
| TEC | SFHR | 8 | 343 | 52,400 | 106,000 | 10,400 | 8,200 | 2,180 |
| Total | | | 489 | 114,600 | 177,200 | 11,600 | 8,520 | 4,950 |

a/ Water Quality and Waste Treatment Requirements on the Upper Holston River, Technical Study TS-03-71-208-07, EPA Region IV, July 1972, Appendix B.

b/ This stands for South Fork of the Holston River.

c/ This load was not significantly greater than that of raw water.

d/ This stands for Holston River.

e/ NA stands for Not Analyzed.

f/ This value is average yearly summary of plant records.

maintain a minimum concentration of 3.0 mg/l DO in the Holston River, the total pollution loads discharged should be limited to approximately 14,000 lb BOD/day and approximately 1,950 lb total Kjeldahl-nitrogen/day. To maintain a minimum concentration of 5.0 mg/l DO, the official standard, the total pollution loads discharged to the South Fork of the Holsten River should be limited to approximately 6,000 lb BOD/day and 100 lb TKN/day; the total load discharged to the Holston River from the Holston Army Ammunition Plant, Area B, should be limited to approximately 1,400 lb BOD/day and 90 lb TKN/day. As discussed previously, the limits of BOD and total Kjeldahl-nitrogen were recommended for these waste sources [Table VI-1].

The 1972 study disclosed that there had been some reduction in the waste loads of BOD, total Kjeldahl-nitrogen, and ammonia, but that the nitrate-nitrite-nitrogen and suspended solids loads had increased significantly. During the survey, the combined waste loads from the Tennessee Eastman Company, Mead Papers, and the Holston Army Ammunition Plant, Areas A and B, amounted to 95 percent of the BOD (108,900 lb) and suspended solids (168,400 lb), 99 percent of the total Kjeldahl-nitrogen, (11,450 lb), and all of the nitrate-nitrite nitrogen (4,900 lb).

Subsequent to 1969 study, the State of Tennessee orally informed the major industries in the Kingsport area, with the exception of HAAP that a minimum BOD removal of 85 percent would be required. However, these limitations were never established in writing, nor has any implementation schedule ever been set up. Moreover, the 85-percent-removal requirement would not be adequate to meet either the water-quality standards or the

EPA interim Effluent Guidelines, whichever is the most limiting.

Regarding pollution control needs at HAAP, the State deferred informing the Department of the Army of the BOD limitations because HAAP is a Federal facility. Therefore, pollution control is the responsbility of the United States Government, pursuant to Executive Order 11507 (Prevention, Control and Abatement of Air and Water Pollution at Federal Facilities; February 5, 1970). This order requires that:

1. Federal facilities conform to air- and water-quality standards and related plans of implementation, including emission standards, adopted pursuant to the Clean Air Act, as amended, and the Federal Water Pollution Control Act, as amended, and more recently, the 1972 Amendments of the Federal Water Pollution Control Act, specifically Section 313.
2. Federal agencies will propose performance specifications employing the best techniques and methods available for the protection and enhancement of air and water quality,* and
3. Federal agencies shall provide leadership in the Nationwide effort to protect and enhance the quality of the Nation's air and water resources

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* Pertinent sections of the Act that would seem to have full application to Federal facilities and Army munitions manufacturing plants include Sections 301 and 302 dealing with Best Practicable Control Technology required by 1 July 1977, the Best Available Technology required by 1 July 1983, which shall be directed to the National goal of eliminating the discharge of all pollutants. Additionally, Sections 306 and 307, respectively, deal with standards of performance to be established through best available demonstrated control technology for new pollution sources and with the establishment of toxic and pretreatment effluent standards.

From these requirements it is clear that Federal agencies are directed, by Presidential Order and by Law, to ensure that adequate air- and water-pollution control measures are in effect at all Federal facilities.

The treatment needs for the waste sources discussed on this section were based on a) effluent limitations that are achievable by the installation of best practicable control technology and b) compliance with applicable water-quality standards: the protection and enhancement of of receiving water quality could require treatment beyond that considered best practicable.

Effluent guidelines have been established for municipal wastes and for most industrial categories of the kind evaluated, with the exception of TEC and HAAP.

## B. TENNESSEE EASTMAN COMPANY

The Tennessee Eastman Company, a division of the Eastman Kodak Company, is one of the largest chemical manufacturers in the United States and produces more than 275 different chemical products (14,500,000 lb/day) in three principal categories: plastics, fibers, and chemicals.

According to the Refuse Act Permit Program Application (RAPP), filed 30 June 1971, the plant withdraws a total of 358 mgd from the South Fork of the Holston River and purchases 0.14 mgd from the City of Kingsport. Approximately 10 percent of the intake water is treated. Water is used for cooling purposes (336 mgd), boiler feed (3.7 mgd), process water (16.8 mgd), and for other purposes (1.1 mgd). Sanitary wastes (0.35 mgd) are discharged to the municipal wastewater treatment plant, and 1.7 mgd of water is lost through evaporation.

Waste-Source Evaluation

The waste discharged to the river was characterized during a five-day period, 4 through 9 December 1972. The combined flow from the seven TEC outfalls was approximately 343 mgd. The BOD discharged was greater than 52,000 lb/day, and the TKN and suspended solids loads averaged 10,400 lb/day and 106,000 lb/day, respectively. The 1969 study reported the discharges to contain 69,300 lb BOD/day; 16,100 lb TKN/day; and 7,800 lb suspended solids/day; corresponding values reported in the RAPP application were 28,800 lb BOD; 13,000 lb TKN; and 86,400 lb suspended solids.

Several heavy metals are used as catalysts at the plant. Loads of heavy metals discharged daily were approximately 9,500 lb manganese, 600 lb zinc, and 1,800 lb iron. Sediments taken from the river downstream had concentrations as high as 22,700 mg/kg for iron and 2,800 mg/kg for manganese. The discharge of manganese is considered responsible for the concentrations (0.21-0.40 mg/l), in the Holston River at Church Hill Bridge (Station 56), exceeding the U.S. Public Health Service recommended drinking water standards (0.05 mg/l Mn) and also resulting in violations of the Tennessee standards for domestic raw water supply [Appendix A-Item 1(K) other pollutants].

As previously discussed [Section VI], the heated discharges from this industry combined with those from HAAP A increased the temperature of the Holston River -- on one occasion by 9°C, but in most cases by 4°C or less. However, violations of the temperature standards for waters classified suitable for fish and aquatic life occurred. High-flow conditions during the survey tended to diminish the effects of the heated discharges.

The treatment system located on Long Island (formed by a sluice in the South Fork of the Holston River) that converts process wastes was evaluated in order to determine the overall performance. The influent flow averaged 10.4 mgd and contained more than 76,500 lb BOD and 50,600 lb suspended solids. The effluent contained more than 35,100 lb BOD/day and 56,100 lb suspended solids/day. The treatment efficiencies of the facility were as follows:

| Parameter | % Removal |
|---|---|
| BOD | 54 |
| COD | 65 |
| SS | 10 (increase) |
| $NH_3$-N | 14 |
| Total P | 49 |
| Mn | 260 (increase) |

Wastes discharged from Station 14 (Outfall to the Sluice-Appendix C) and Station 17 (Long Island Lagoon Effluent) contained complex mixtures of organic compounds [Table E-18]. Among the compounds detected were alkylated phenols, alkylane benzenes, phthalic acid esters, trichlorobenzene (Station 17) and trichloroaniline (Station 17). Both the latter are known to be toxic to aquatic life. Static bioassay studies were run on five waste effluents from this plant (Stations 12, 14, 17, 22 and 23). The waste from Stations 12, 14, 22, and 23 were not toxic to fathead minnows in 100 percent concentrations for 96 hours. However, the studies showed that wastewaters from Station 17 were toxic to fish. The 96-hr $TL_m$ derived from the static bioassays with fathead minnows was with a waste concentration of 64 percent. Other static bioassays using bluegills showed the 96-hr $TL_m$ to be at a waste concentration of 36 percent. Based upon 1/20 of the 96-hr $TL_m$ it was calculated that toxic wastewater from Station 17 would have to be diluted by maintaining approximately 800 cfs in the South Fork of the Holston River to protect aquatic life. The discharge of these toxic wastes constitutes a violation of the water quality standards for fish and aquatic life [Appendix A; item 3 (g)--Toxic Substances].

Wastewater (Station 20) discharged to the Kingsport Municipal Wastewater Treatment Plant contained organic compounds that could be toxic to biological treatment systems or pass through the plant untreated [Table E-18]. Compounds identified were *m*-chloroaniline, 2-ethyl-1-hexanol, *m*- and *p*-xylene, ethoxyethyl acetate, and eight long-chained alkanes.

## Treatment Needs

As discussed earlier, a waste-source evaluation and stream survey in July 1969 reported that the Tennessee Eastman Company was discharging approximately 69,300 lb BOD; 16,100 lb TKN; and 7,800 lb suspended solids daily to the South Fork of the Holston River. The BOD and total Kjeldahl nitrogen discharged comprised about 50 percent and 83 percent, respectively, of the total BOD and TKN loads discharged.

The 92-percent reduction considered necessary in the 1969 survey for the protection of receiving water quality required that TEC discharge no more than 6,000 lb BOD and 1,600 lb TKN/day. However, to maintain a minimum concentration of 5.0 mg/l DO in the Holston River, the BOD and TKN discharged in the process wastewaters should not exceed 3,350 lb/day and 400 lb/day, respectively.

Effluent guidelines have not been established for this industry. However, the following process waste effluent limits are considered necessary to protect water quality:

1. BOD--3,350 lb/day;
2. TKN--400 lb/day;
3. Suspended Solids--30 mg/l over background levels;
4. Total heavy-metals content (i.e. Zn, Mn, etc.) not exceed 1.0 mg/l; and
5. pH--6.0-9.0

In addition to these concentrations, levels of toxic substances must be reduced to 1/20 of the 96-hr $TL_m$ and, in now case, should the dilution afforded by the receiving water be considered a substitute for treatment. Moreover, to prohibit violations of the standards the temperature of the heated discharges will need to be reduced. Cooling devices, concluded as necessary in the 1969 report, should be installed.

The major sources of BOD were, from Hales Branch (Station 12), 14,000 lb/day and from the Long Island effluent (Station 17), 35,000 lb/day. All of the TKN, 10,400 lb/day, was contributed from Station 17. The Long Island lagoons receive 10.4 mgd of process wastes while Hales Branch receives 311 mgd of combined cooling water and process wastes.

To meet the aforementioned limits and any additional effluent requirements established by the State of Tennessee, the Tennessee Eastman Company should procede immediately to separate all process waste and non-contact cooling water streams. The best practicable treatment technology currently available must be applied to the process wastes. Recycling and re-use of water and good housekeeping procedures should be incorporated in any proposed abatement plan. A schedule for achieving the necessary pollution abatement should be provided EPA Region IV, within the next six months. The control measures necessary should be operational no later than 1 July 1975.

The permit issued to this industry should require a routine monitoring and sampling program of sufficient detail to ensure compliance with the effluent limits and protection of receiving-water quality.

## C. HOLSTON ARMY AMMUNITION PLANT* - AREA A

### General

Facilities of the Holston Army Ammunition Plant (HAAP), a Federal installation, are in two separate locations, Areas A and B, in the vicinity of Kingsport, Tennessee. HAAP is the property of the Department of Defense, Department of the Army, but is operated and managed, under contractual agreement, by the Holston Defense Corporation, a TEC subsidiary.

HAAP is the only munitions plant under the control the the Army Procurement and Supply Agency (APSA) that manufactures RDX-HMX explosives. They are admixed with TNT (TNT being received from sources outside the

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* Much of the information on Area A and B concerning process operations, waste sources, effluent criteria and proposed abatement plans has been obtained from four military documents—References 5, 6, 7 and 8.

HAAP facilities) and various chemicals, desensitizing agents fillers, etc., for primary use in manufacturing military explosives. Explosives are also prepared for use by the National Aeronautics and Space Administration. According to HAAP, its manufacturing capability includes about 50 RDX-HMX product variations of which Composition B is the most prominent. (Composition B is an extremely powerful explosive, made up of RDX, TNT, and wax.)

Applications under the 1899 Refuse Act Permit Program have previously been filed with the U. S. Corps of Engineers for all waste discharges from HAAP, Areas A and B.

## Waste-Source Evaluation

Area A is situated within the corporate boundaries of the City of Kingsport, occupies about 134 acres, and borders on the South Fork of the Holston River [Figure IV-1]. Area A can, for most purposes, be considered the organic-acid manufacturing facility of HAAP. Major processes at HAAP Area A, include the manufacture and refining of acetic anhydride and the concentrating and refining of acetic acid (principally recovered from Area B). In recent months Area A has been operating at between 40 and 50 percent of its total manufacturing capacity.

Water for cooling and process needs within Area A is diverted from the South Fork of the Holston River, a short distance upstream of the Tennessee Eastman Company waste outfalls. A portion of the river-water flow is filtered and softened. Of this amount 0.8 mgd is used for boiler feed and 0.7 mgd as process waters. Average water intake during the waste-source survey was estimated to be about 47 mgd. Of this amount cooling-water use was estimated as 42 mgd. Process-water needs vary from 0.8 to 4.4 mgd. Area A also uses 0.2 mgd of city water for sanitary purposes.

Wastewaters* From Acetic-Acid Concentrating and Refining -- Cooling waters plus spent process waters and sludges from this area are discharged through the main outfall ditch (Station 2**). These wastes are reported to contain nitromethane methyl nitrate, acetic acid, n-propyl acetic, nitric acid, and trace amounts of explosives.

Wastewaters From Acetic Anhydride Manufacturing -- These waste flows contain acetic anhydride, acetic acid, acetaldehyde, acetonitrite, methyl acetate, methyl nitrate, ethanol, methanol, ethyl acetate, propanol, and propyl acetate. The waste streams are mixed with cooling waters needed in the anhydride manufacturing and then discharged to the South Fork of the Holston River [Station 3].

Wastewaters From Production Gas Plant Area -- These consist of waters from the scrubbing units and cooling and condenser water. Total water usage and ensuing wastewater discharges from this area depends upon the degree of recycling practiced. The Army reports that "excess cooling and condenser waters amount to 0.17-0.18 mgd." Discharges from this area are reflected on the results shown at Station 3 which also contained acetic-anhydride manufacturing wastes and at Station 4 [Table E-23].

Wastewaters From Acetic-Anhydride Refinery Area -- These include cooling and condenser waters and process waters plus a portion of the

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* Detailed information on the various processes and associated waste sources can be found in the subsection "Process Operations and Waste Sources" HAAP, Area A, [Appendix E].

** [Stations are described in Appendix C.]

the sludges from the refining columns and the azeotropic distillation columns (some concentrating of acetic acid is also carried on in this area). These wastes are discharged to an industrial sewer, and their presence is confirmed by the results obtained at Station 2.

Miscellaneous Wastes From Steam Generation Plant, Tar-Tank Area, and Water Filter Plant — These contribute to the total waste load. Wastes from the tar-tank area [Station 8] averaged 3,600 mg/l phenols (range: 1,100-5,800 mg/l). Moreover, this waste discharge was found extremely toxic in the bioassay tests to be discussed later.

Discussion — At the present time, all spent cooling waters, water-treatment filter sludges, and industrial wastes from Area A are being discharged with essentially no treatment to the South Fork of the Holston River. During the survey the daily waste loads from Area A averaged 20,300 lb BOD; 4,060 lb suspended solids; and 19,100 lb COD [Table VII-2]. The average discharge was about 43 mgd. [Analytical results for those parameters measured are contained in Table E-23.]

Comparison of the 1972 EPA study data with that collected by the U. S. Army Environmental Hygiene Agency (USAEHA) and that contained in the RAPP application are as follows:

TABLE VII-2

WASTEWATER VALUES - SUM OF ALL OUTFALLS*

| | USAEHA | RAPP | 1972 EPA |
|---|---|---|---|
| Flow (mgd) | 37.6 | 40.3 | 43.3 |
| BOD (lb/day) | 9,360 | 9,920 | 20,300 |
| COD (lb/day) | 13,200 | 25,500 | 19,100 (approx.) |
| SS (lb/day) | 6,060 | 68,000 | 4,060 |

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* Production levels have remained fairly constant.

Differences between the 1972 data and the previous USAEHA series of data are critical because the latter figures were used to provide specific engineering design criteria for the proposed biological treatment systems (aerated lagoons). The USAEHA loadings for BOD and COD are about one-half those of the 1972 EPA survey results. These differences could greatly alter expected performance of the aeration basins.

Several of the waste discharges from Area A are heated. For example, the temperature of the main outfall ditch (Station 2 -- 33.6 mgd average) discharge ranged from 18°-20°C. As mentioned previously, the heated discharges from Area A and TEC effect a violation of the temperature standards that prohibit no more than a 3°C temperature rise above background conditions. The 1969 survey concluded that cooling devices were necessary at both industries.

Effluents from the main outfall (Station 2) and the coal-tar drainage (Station 8) at Area A were tested and found to be toxic to fish. The waste concentrations for the 96-hr $TL_m$ derived from static bioassays was 56 and 0.39 percent for Stations 2 and 8, respectively. Flow-through bioassays produced a 48-hr $TL_m$ of 25 percent waste concentration for Station 2 and a 96-hr $TL_m$ of 0.17 percent for Station 8. Based upon a factor of 1/20 of the 96-hr $TL_m$, it was calculated that these two waste discharges would require that about 2,000 cfs be maintained in the South Fork of the Holston and Holston Rivers to ensure no long-term damage to aquatic life due to toxicity. The concentrations of toxic materials in the Holston River immediately downstream from Kingsport are approaching levels that could be toxic to fish. The discharge of these toxic wastes into the river violates the Tennessee Water Quality Standards for Fish and Aquatic Life (Subsection 3g.-Toxic substances).

To complete the evaluation of pollution sources in Area A it is appropriate to itemize sources of air pollution derived from processes already described in some detail.

Vent Gases Off Azeotropic Distillation Columns — At current production rates these vent gases are reported to contain about 530 lb/day of methyl nitrate, liberated in a mixture of nitromethane, methyl acetate, propyl formate, propyl acetate, and methyl nitrate. The total solvent vapors vented to the atmosphere approach 1,100 lb/day. Methyl nitrate is especially toxic and has a high explosive-and-impact sensitivity hazard.

Gases From Acetic-Anhydride Area — Gases from this area contain about 5,400 lb of hydrocarbons and 6,400 lb of carbon monoxide/day.

Vent Gases From Producer-Gas Manufacturing Area — Vent gases from the producer gas contain particulate matter, sulfur oxides, and nitrogen oxides.

Gases From Coal-Fired Steam Plant — Air pollutants from this plant include 16,000 lb of particulates, 8,000 lb of sulfur oxides plus unknown amounts of other materials.

## Treatment Needs

The air- and water-pollution abatement schedules proposed by the Munitions Command (MUCOM) for Area A have been outlined [Table E-25]. However, funds have not been appropriated beyond FY 73. Moreover, there are a number of deficiencies in the abatement plan. For example, there is no schedule for the separation of uncontaminated cooling waters from process waters; this is considered a necessary first step in achieving effective water pollution control in Area A. Additional information is required in order to determine the step-by-step abatement activity and the implementation schedules to be undertaken at HAAP. Abatement items have not been adequately described in the schedule so that their relationship to the other projects can be determined. Some abatement projects, such as the construction for controlling and routing tank-farm waste spills to the aerated lagoon, will be completed several years in advance of the latter system which is to be carried out in 1976.

During the survey the pilot-plant aerated lagoon (4.5 mgd) was under construction.* Several aspects of the proposed biological systems warrant attention. The systems were designed using waste loads measured during a study by the USAEHA. The waste loads, found by USAEHA, as discussed earlier, were considerably lower than those found in 1972; thus, the expected performance of the aerated lagoons could be greatly altered. Moreover, the system is incompatible with best practicable control technology.

Another aspect deals with the types and amounts of wastes to be treated and the effect of these wastes on biological treatment efficiency. Through increased recycling, re-use, and recovery of process flows plus the segregation of uncontaminated cooling waters, total process wastewaters at Area A could be reduced to 1 mgd or less. Available data indicate that these process effluents per se are extremely strong in COD, complex organics, toxicity, and possibly, heavy metals. Based on this data and similar experiences, the implied risk of using biological treatment is high. These wastes are judged to be more adaptable to physical chemical treatment than biological treatment as presently planned.

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* It should be noted that this pilot aeration lagoon was scheduled for completion in December 1972 but had not been completed as of early March 1973.

The 1969 study of the Holston River concluded that the BOD load from Area A must be reduced to about 1,900 lb [Table VII-1]. This is more than a 90-percent reduction from the BOD load discharged during the 1972 survey.

To data EPA interim Effluent Guidelines have not been developed for this industry. However, APSA has developed Air and Water Quality Standards [Tables VII-3 and VII-4] for munitions manufacturing plants. Those criteria are judged to be controlling for waste-abatement practices at Army munitions facilities, such as HAAP, and, relative to the BOD, SS, ammonia, and nitrate levels established, these criteria appear consistent with those levels obtainable with the use of the best practicable control technology currently available. The total heavy metals concentration of 5.0 mg/l allowed by the APSA Guidelines is considered excessive when compared with the total metal standards established in the effluent guidelines for other industries (i.e., 1.0 mg/l).

Information contained in the Army reports of a waste survey implies that spills, leaks, and errant discharges are relatively common in the tank-farm and materials-storage areas. A program for the prevention and containment of strong waste spills is necessary. Such a program and associated contingency plan would require preventative maintenance and

### TABLE VII-3

### SELECTED WATER QUALITY STANDARDS[a]

| Pollutant | Effluent Standard ppm | Boundary[a] Standard ppm |
|---|---|---|
| Color (Color Units)[b] | 3-30 | 3-30 |
| Maximum Temperature (°F) | c/ | 90 |
| Oil (ppm) | 15 | no visible oil on water surface |
| Biological Oxygen Demand (ppm) | 15.0 | 2.0 |
| Chemical Oxygen Demand (ppm) | 20.0 | 2.0 |
| Total Organic Carbon (ppm) | 30.0 | 3.0 |
| Phenols (ppb) | 10 | 10 |
| pH (standard units) | 6.0-8.5 | 6.0-8.5 |
| Solids, Dissolved (ppm) | 500 | 200 |
| Solids, Suspended (ppm) | 25 | 25 |
| Bacteria-monthly average (No./100 ml)-% of samples (Coliform count) |  | (5000)-20<br>(2000)-5 |
| TNT and Nitrobodies (ppm) | 0.5 | 0.3 |
| Ammonia (ppm) | 0.1 | 0.01 |
| Nitrate (ppm) | 5.0 | 0.5 |
| Phosphate (ppm) | 0.5 | 0.05 |
| Total Heavy Metals[d] | 5.0 | 5.0 |

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a/ Standards are as prepared by APSA. It is assumed that effluent standards refer to the process wastewater streams after treatment whereas boundary conditions refer to all waters discharged, i.e., cooling water included. [A complete set of these standards is contained in Table E-24, Appendix E.]

b/ Color units are based on platinum-cobalt standard.

c/ State water ambient temperature shall not be increased by more than 5°F, with the hourly temperature change of the State water not to exceed 1°F.

d/ This total includes cadmium, chromium, copper, lead, mercury, nickel, zinc, etc, which have individual limits Table E-24, Appendix E].

## TABLE VII-4

## SELECTED AIR QUALITY STANDARDS PROPOSED BY APSA

### Design and Operating Standards (Proposed)

| Pollutant | Boundary Standard (ppm) | Stack Emission Standard (ppm) |
|---|---|---|
| Ammonia | 0.15 | 100 |
| Carbon Monoxide | 0.15 | |
| Hydrocarbons | 0.20 | 200 |
| Lead | 0.5 $\mu g/M^3$ [a] | |
| Nitrogen Oxides[b] | 0.10[c] | 200 |
| Oxidants | 0.04 | |
| Ozone | 0.03 | |
| Particulates | 80 $\mu g/M^3$ [a] | 200 $mg/M^3$ |
| Particulates, Incinerator | 80 $\mu g/M^3$ [a] | 450 $mg/M^3$ |
| Sulfur Dioxide, Power Plant | 0.04[d] | 500 |
| Sulfur Dioxide, Acid Plant | 0.04[d] | 200 |

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[a] This is a maximum value for any 24-hr sample period.

[b] Nitrogen oxides include $NO + NO_2$.

[c] Average value for measurable limits over a one-hr period is not to be exceeded more than 1.0 percent of the time over a three-month period.

[d] Maximum value is not over one percent of the time in a 24-hr sample period.

inspection procedures, adequate diking, or curbs around tank-storage areas, in order to prevent spills and surface runoff from reaching the water course. In no event should spills be allowed to enter sanitary, process or cooling-water sewers. Complete containment, recovery or treatment of spills, etc., is necessary at Area A.

Waste discharges from the tar-tank area must be eliminated. In addition, toxic substances in the remaining discharges must be reduced to at least 1/20 of the 96-hr $TL_m$ in order to protect fish and aquatic life. In no case should the dilution afforded by the receiving stream be considered a substitute for treatment.

To abate its air-pollution problems at Area A, the Army is proposing control and treatment for the vent gases from the acetic-anhydride manufacturing and refining processes and from the producer gas area. Control measures for $NO_x$ and $SO_x$ are presently being studied.

## D. HOLSTON ARMY AMMUNITION PLANT* - Area B

### Waste-Source Evaluation

Area B is located on 6,370 acres immediately downstream from the confluence of the North and South Forks of the Holston River [Figure IV-1] and approximately six miles west of the City of Kingsport and Area A. The major processes at Area B include nitric-acid and ammonium-nitrate production; the preparation, manufacturing, and packaging of various explosives; and the recovery of waste acetic acid for shipment to Area A. (Areas A and B are interconnected by a railroad spur and by a series of stainless steel pipelines, laid parallel to the tracks. The lines serve to convey raw materials and intermediate products between the two HAAP manufacturing facilities.)

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* Much of the information concerning process operations, waste sources, effluent criteria, and proposed abatement plans has been obtained from two Army documents.

Area-B records* indicate that approximately 84.4 mgd of water is pumped from the Holston River through intake screens at two pumping stations. About 14.5 mgd of this is intended for use as process water, and, therefore, is treated by flocculation, sedimentation, and filtration. Of this filtered water, approximately 0.75 mgd is de-ionized for use as boiler-feed water. During the survey the total of all wastewaters discharged to the river was 84.6 mgd. A natural stream entering the plant grounds (Arnotts Branch) contributed 11.4 mgd so that the net waste flow was approximately 73 mgd.

Wastewaters Associated With Production And Concentration Of Nitric Acid — The wastes from the production process contain ammonia, nitric acid, nitrite ion, and a small amount of oil from the compressors employed in the ammonia-oxidation process. These wastes together with cooling waters are discharged without treatment via the main outfall ditch to the Holston River (Station 33). Wastewaters from the concentrating process are essentially all cooling waters. These also go to the main outfall ditch. During the survey the waste discharge from this ditch averaged 53 mgd and contained average loads of 2,400 lb BOD; 20,500 lb SS; and 1,920 lb $NO_2 + NO_3$-N [Table E-29].

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* These have been calculated from pump-rating curves.

Wastewaters From Production, Purification, And Packaging of Explosives -- At Area B the manufacture of the explosive compounds is carried out in a series of buildings where glacial acetic acid and acetic anhydride are received from Area A and nitric acid and the ammonium nitrate-nitric acid solution is received from elsewhere in Area B. Other materials (outside purchases) for use in the process enter the complex here, too. These other materials include hexamine (hexamethylene tetramine), wax, TNT (trinitrotoluene), lacquer, and several desensitizing agents.

The hexamines are dissolved in glacial acetic acid, and the solution is then mixed with a nitric acid-ammonium nitrate solution to yield crude RDX and HMX. Contaminated waste streams from these operations are routed through a catch basin and then to the industrial sewer. The waste flows include cooling water, condensate, seal water, and floor and equipment wash-down water, as well as possibly containing RDX, HMX, acetic acid, hexamine, and other organics. These flows were monitored at Stations 28, 29, 31, and 33.

Following this process, the crude RDX and HMX slurry is subjected to a filtering and washing process. From this operation the wastewaters containing explosives, acetic and nitric acids, and other components of the mixture pass through baffled catch basins before entering the industrial sewer. There is also good evidence of the quality and quantity of these wastes from the data obtained from sampling at Stations 28, 29, 31, and 33.

The washed explosive slurry is then sent through a recrystallization process. Depending upon the crystal configuration desired, the solvent to be used varies between cyclohexane, acetone, and toluene. The waste stream containing solvents, explosives, and lacquers passes through baffled catch basins before entering the sewers. Samples were collected at Stations 28, 29, 30, 31, and 32.

Subsequent to the process just described, the explosive slurry is subjected to a grinding process and is then dewatered. Ground, dewatered explosives (wet cake) are then sent to the compounding process. The wastewaters consisting of explosives, solvents, condensate, acetic acid, settling tank overflow, and wash water were included in the flows passing Stations 28, 29, and 31.

Compounding of the explosives involves mixing RDX or HMX with melted TNT to yield Composition B. This material is heated, wax is added, and the mixture is cooled. After the compounding process, the explosives are passed through a packing process. Dust from this operation is exhausted from the buildings and scrubbed with water. The scrubber water, floor and equipment wash down, wastewater from the compounding process (consisting of explosives including TNT) are also included in wasteflows at Stations 28, 29, and 31.

Wastewaters from the two water filtration plants* -- These include wastes from cleaning the intake screens, backwashing the filters, and desludging the sedimentation basins. The quality was measured at Station 25.

Sanitary wastes -- This wastewater, including domestic wastes from several homes in the immediate vicinity, receives secondary treatment consisting of primary sedimentation, trickling filtration, secondary clarification, and chlorination. The effluent (Station 26) was of good quality.

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* Only one water treatment plant was operational during the survey.

Discussion -- During the survey the total BOD discharged from Area B averaged 14,750 (net, 10,000 lb*) lb/day; the average total Kjeldahl-nitrogen and $NO_2 + NO_3$-N measured approximately 600 and 2,500 lb/day, respectively. When compared with the discharge measured during the 1969 survey [Table VII-1] loads of the BOD and TKN are significantly less; the nitrite + nitrate load is similar. The complex nature of the Area-B wastes and the possible effluents upon analytical procedures probably accounts for the low BOD.

Complex organic analyses were performed on a mixed sample (composited over a 24-hr period using equal aliquots) from Stations 28 and 29, with a combined flow of 4.24 mgd. These waste discharges came from the explosive manufacturing area [Appendix C]. Using the same procedure, a mixed sample was also collected from Stations 31 and 33 and analyzed for complex organics. These stations had a combined flow of 55.3 mgd and contain process wastes from the production, purification, and packaging of explosives. [The organic chemicals isolated are listed in Table E-30.] The quantities of TNT and cyclohexanone discharged from Area B represent a serious hazard to aquatic life in the Holston River. The cyclohexanone and TNT in the discharges from Stations 28 and 29 ranged from 15.3 to 76.9 lb and 9.1 to 46 lb/day, respectively. The amount of cyclohexanone from Stations 31 and 33 ranged between 54 lb to 1,240 lb/day. These quantities are likely to result in adverse effects of a chronic nature through continuous exposure of aquatic life.

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* The BOD load in the two intake water streams has been subtracted from the gross loads.

Static bioassay studies on streams 28 and 30 after mixing but prior to entering the river yielded a 96-hr $TL_m$ with a waste concentration of 23 percent; the 72-hr $TL_m$ from a flow-through bioassay was 13 percent.

In addition, the effluent from Station 31 was tested and found to be toxic to fish. A flow-through bioassay indicated that the 96-hr $TL_m$ occurred in a waste concentration of 23 percent. Based upon 1/20 of the 96-hr $TL_m$, a river flow of approximately 2,600 cfs would be required to adequately dilute toxic materials contained in Area B wastewaters (Stations 29, 30, and 31) to protect stream life in the Holston River. Moreover, these discharges of toxic substances constitute violations of the Tennessee Standards on toxicity for waters classified suitable for Fish and Aquatic Life.

To complete the evaluation of waste sources in Area B it is appropriate to itemize sources of air pollution derived from processes already described in some detail.

Nitric-Acid Production And Concentration -- The nitric-acid producers, at full capacity, release about 17,000 lb of $NO_x$/day to the atmosphere. The level of $NO_x$ in the general area is greater than 5 ppm, the maximum level recommended for personnel. The nitric-acid concentrators, at full production, contribute about 5,200 lb of $NO_x$/day.

Open Burning Of Trash -- About 13 tons of refuse and explosive wastes are burned each day by open-burning techniques. It is estimated that this operation adds 1,410 lb of contaminants to the atmosphere each day.

Steam Production -- The six coal-fired and the three natural-gas or oil-fired boilers release each day about 28,000 lb of particulates and 11,000 lb of sulfur oxides to the atmosphere.

Treatment Needs

The proposed air- and water-pollution abatement schedule for Area B has been documented [Table E-31]. As noted for the abatement projects scheduled for Area A, there have been no funds appropriated beyond FY 1973. (The same deficiencies noted in the Area-A abatement plans also exist in the Area B plans.)

The reservations expressed for the proposed biological systems at Area A apply to the proposed Area-B systems. CERL has conducted a few treatability studies on the Area-B wastes and has found that, after the organisms became acclimated, the wastes were treatable by biological processes. However, because of the numerous organic and toxic chemicals present it is questionable whether a biomass could be kept viable and, if it does survive, whether complex organic materials, such as RDX, HMX, TNT, and cyclohexanone, will be degraded.

If biological processes are employed for treating process streams, the biological system should serve only as first-stage treatment. Should a biological process not be applicable, the first stage could consist of chemical coagulation followed by flocculation and sedimentation. Either kind of first stage should be designed to produce an effluent with a suspended-solids concentration of approximately 30 to 40 mg/l. A second stage possibly consisting of carbon adsorption or oxidation with ozone will be necessary to order to remove the complex organics, many of which are toxic.

Nitrogen (TKN and $NO_2 + NO_3$) removal will be necessary at Area B. If the aforementioned two-stage system is employed, the nitrogen in the effluent should be present primarily in the nitrate state and could be removed using, for example, biological denitrification.

The proposed industrial waste lagoons (aerated) were designed (by CERL) using State of Tennessee Standards (effluent limits - 450 mg/l of BOD and 180 mg/l of suspended solids). Because treatment beyond that presently proposed will be necessary at *both* Areas A and B the APSA standards should be employed (with the exception of the heavy metals standard which should be reduced from 5.0 mg/l to 1.0 mg/l) as the basis for design. Toxicity levels in discharges will need to be reduced to 1/20 of the 96-hr $TL_m$, and in no case can dilution afforded by the receiving water be considered in place of treatment.

Plans for pollution abatement at the water-treatment facility call for land disposal of material removed from the intake screens, continuous sedimentation of backwash water with solids going to thickeners, sand-bed drying and ultimate disposal at a landfill. The sedimentation basins will be converted to continuous sludge removal; the sludge will be thickened, dried in sand beds, and disposed of at a landfill. This proposed control measure is considered adequate.

To abate air-pollution problems HAAP plans to reduce $NO_x$ emissions from the nitric-acid producers and concentrators by the use of molecular sieves. They should reduce the stack emission from 3,000 ppm down to 50 ppm. The $NO_x$ adsorbed will be recovered as dilute nitric acid. Consideration is being given to the use of electrostatic precipitators or wet scrubbers for the removal of particulate matter from the boiler-building stack gas.

## E. MEAD PAPERS, A DIVISION OF MEAD CORPORATION

### Waste-Source Evaluation

Mead Papers, an integrated Kraft mill, manufactures 250 tons/day of pulp by the hot-soda process; an additional 240 tons/day of pulp is imported. The pulps are combined with fillers* to produce about 540 tons/day of paper. Approximately 17 mgd of the wastewater is treated in a 150-ft dia. clarifier (Station 41) before being combined with about 1.5 mgd of untreated wastes and water-treatment-plant wastes. The combined wastes are discharged to the South Fork of the Holston River (RM 142.15/2.5). A RAPP application has been filed for this discharge.

The combined daily wasteload discharged contained 21,550 lb BOD (148 mg/l), 31,500 lb suspended solids (216 mg/l), and 451 lb total Kjeldahl-nitrogen (3.3 mg/l). These loads of BOD and suspended solids are equivalent to 47 lb and 68.5 lb/ton of product, respectively. During the survey the waste stream to the river was dark brown in color and had a significant amount of foam on the surface.

The 1969 FWQA study reported an effluent quality similar to that observed in 1972. The BOD, suspended solids, and total Kjeldahl-nitrogen concentrations were measured at 168, 160, and 2.9 mg/l, respectively. The quality of the backwash from the water-treatment plant was not measured during the 1969 survey.

### Treatment Needs

A 23-acre aerated lagoon (eight 60-hp surface aerators) to treat the primary clarifier effluent was under construction at the time of the 1972 survey. The company also plans to install a defoaming process and construct a submerged diffuser across the river to provide for better wastewater diffusion. The State of Tennessee orally informed the company the the waste load must be reduced to 6,000 lb/day maximum (13 lb/ton of product). However, the State has not established an implementation date or put the requirement in writing. Mead officials indicated that, if the aerated lagoon performs as anticipated, the effluent will meet the 6,000 lb BOD/day requirement.

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* Fillers that are used in the process are kaolin, calcium carbonate, titanium dioxide, copper silicate, and diatomaceous earth.

EPA interim Effluent Guidelines have been established for the pulp and paper industry based on best practicable control technology. These effluent limitations require that the BOD and suspended solids not exceed 9 lb*/ton of product each (28 mg/l of each at present flow of 11 mgd). However, these limits are not stringent enough for this plant. The 1969 study determined that in order to maintain a minimum concentration of 3.0 mg/l DO in the Holston River and to protect and enhance the receiving waters the BOD load not exceed 2,000 lb/day (4.4 lb/ton of product). However, to maintain a minimum concentration of 5.0 mg/l DO, the BOD in the effluent should not exceed 1,100 lb/day (2.4 lb/ton). To reduce the BOD to this level would require the installation of additional treatment facilities.

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* The limit for Kraft pulping and manufacturing of bleached grades was used for half the production, and the limit for manufacturing "fine" paper from purchased pulp for the other half of production was used in the calculation of this value.

The permit issued for this plant should include the following effluent limits:

1. BOD - 1,100 lb/day
2. Suspended Solids - 1,100 lb/day
3. pH - between 6.0 and 8.0 (not to be outside this range at any time)

Limits for color, toxic materials, fecal coliforms, oil and grease, ammonia, heavy metals, and foam should be set, as necessary, to protect the receiving water quality [Appendix E - Mead Papers]. In addition, both a monitoring and sampling program of sufficient detail to ensure compliance with these effluent limits and the protection of receiving-water quality should be required on the permit.

## F. KINGSPORT MUNICIPAL WASTEWATER TREATMENT PLANT

### Waste-Source Evaluation

The Kingsport Wastewater Treatment Plant is a single-stage, high-rate trickling-filter facility. The plant (6.5 mgd capacity) was not sampled during the survey because of hydraulic overloading due to infiltration from wet-weather conditions; the plant was by-passing raw sewage and storm water* to the South Fork of the Holston River. The by-passing commenced about 0700 hr 10 December and continued until about 1300 hr 14 December. The City does not have plans to eliminate these combined sewers or to provide disinfection of the by-passed water.

A summary of plant records for the period of November 1971 through November 1972 for waste removals at the WWTP indicates that:

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* The City has combined sewers. By-passing occurs at the WWTP when flows exceed 13 mgd. Sewer overflows also occur within the sewerage system when the capacity of individual sewers and lift stations is exceeded.

1. influent BOD was reduced by about 70 percent; and
2. influent suspended solids (SS) were reduced by 74 percent.

The average effluent BOD and SS levels were 57 mg/l (3,130 lb/day) and 36 mg/l (2,190 lb/day), respectively, which does not meet the requirements for secondary treatment that have been proposed pursuant to the Federal Water Pollution Control Act Amendments of 1972.*

Plant operational problems have occurred from influent wastewaters received from several industries connected to the city sewer, in particular the Tennessee Eastman Company and Slip-Not Belt Company. Plant personnel reported toxic materials and highly colored wastewaters from the Slip-Not Belt Company. Together with large quantities of suspended and floating solids from TEC they were responsible for operational problems. The digesters became inoperative in late 1971 and presently do not function properly. The cause of this malfunction has not been positively identified. During the 1972 survey various organic compounds [Table E-18] were identified in the TEC sanitary wastewaters that are discharged to the Kingsport Wastewater Treatment Plant. These organic compounds could be toxic to biological treatment systems at the plant or pass through untreated.

## Treatment Needs

The City is currently not enforcing its Industrial Waste Ordinance

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* EPA is currently proposing to limit BOD and SS, in the effluent, to a monthly average of 30 mg/l and to a weekly average of 45 mg/l, or 85-percent overall reduction, whichever produces better quality effluent. In addition, the effluent should contain no more than 400 fecal coliform bacteria/100 ml on a weekly average nor more than 200/100 ml on a monthly average.

No. 1539 [Appendix F] that requires pretreatment of high organic and suspended solids waste (>300 mg/l BOD, >350 mg/l SS). The ordinance also requires toxic substances (iron, copper, lead, zinc, etc.) to be limited in quantity so that the total contribution will not cause interference in normal plant operations. Enforcement of this ordinance would help reduce the present waste loads into the plant.

Changing the method of operation so that the wastewater is recirculated to the trickling filters before clarification rather than recirculation to the trickling filters after clarification would also improve treatment efficiency. However, even though improvement in the treatment could be obtained by following the latter and the enforcement of the ordinance, the plant as it presently exists cannot meet the proposed EPA interim Effluent Guidelines. Moreover, the 1969 FWQA report concluded that the BOD load from this plant was not to exceed 900 lb/day in order to maintain a minimum concentration of 3.0 mg/l DO in the Holston River and to protect receiving-water quality. To maintain the official standard of 5.0 mg/l minimum DO, the effluent should not exceed 500 lb BOD/day. At the present design flow (6.5 mgd) this would require an effluent BOD which is more stringent than the proposed guidelines. In addition the suspended solids load should be no greater than 500 lb/day; the effluent fecal-coliform concentrations should be in accordance with the prepared EPA limitations.

Corrective measures must be taken to preclude the by-passing of untreated wastes from the plant or from within the sewerage system due to excessive combined flows. Moreover, on one occasion during the survey, by-passing from an interceptor line (i.e., the interceptor line collecting wastes from the J. P. Stevens plant and a residential area) occurred. To prevent this, a sewer maintenance program has to be developed so that sewer inspections, cleaning, and repairs are carried out routinely.

## G. HOLLISTON MILLS, INCORPORATED

### Waste-Source Evaluation

Holliston Mills produces about 250,000 yd (460 tons/day)* of finished products consisting primarily of binding cloth which is divided into two general classes: starch (cornstarch) filled book cloth (about 20 percent) and plastic-covered book cloth (about 80 percent). The latter can include plastic on cloth; plastic on paper; and a combination of cloth and paper.

There are two wastewater discharges to the Holston River from Holliston Mills: the untreated cooling water (Station 45, RM 128.9/0.70) and the treated process wastes (Station 46, RM 129.2) [Appendix E-2, Figure E-3]. A RAPP application has been filed for both discharges.

The wastewater-treatment system, completed in July 1972, is a co-operative research and development project partially funded by an EPA grant. The system includes pH control, screening, primary and secondary clarification, trickling filtration, and lagooning. There are three lagoons. One pond (1/2 acre) receives sludge from the primary clarifier and then overflows to a large polishing pond (two acres). Another pond (1/2 acre) receives the secondary clarifier effluent that also overflows to the large pond [Figure E-3]. Company officials indicated that the ponds are full of solids, thus affecting the treatment capability.

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* The finished product weighs from six to nine oz per running yd.

An in-plant survey was conducted from 6 through 8 December 1972. The wastewaters discharged from the larger lagoon contained average daily loads of approximately 1,940 lb of BOD (380 mg/l); 3,600 lb of COD (703 mg/l); and 200 lb of suspended solids (39 mg/l). The concentrations of sulfide in the effluent ranged from 40 to 50 mg/l. The loads of BOD and COD in the lagoon effluent were higher than those in the influent [Table E-4].

Adequate treatment was not being provided during the survey. The suspended solids and sulfide were reduced. However, the loads of BOD and COD in the effluent were consistently higher than those in the influent. The influent of the lagoon system averaged 0.7 mgd, whereas the effluent was averaging 0.6 mgd, an indication that excessive seepage was taking place. The cooling-water discharge contained average daily BOD and suspended solids loads of 30 lb/day and 90 lb/day, respectively. The flow averaged about 0.3 mgd-considerably less than the 0.8 mgd reported by the company. While the BOD levels remained the same as those of the raw intake water, the average concentrations* of suspended solids increased from 19 mg/l to 40 mg/l; TKN increased from 0.7 mg/l to 1.4 mg/l; total phosphorus increased from 0.2 mg/l to 1.2 mg/l; and sulfate increased from 27 mg/l to 66 mg/l, all indications that the cooling water was being contaminated.

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* [For comparison between the discharges of raw intake water and of cooling water, refer to Table E-4, Appendix E.]

## Treatment Needs

The EPA interim Effluent Guidelines recommend the following limitations on the discharge from a plant of this kinds:

| Parameter | lb/day/1,000 lb product | lb/day (present plant capacity) |
|---|---|---|
| BOD | 6 | 700 |
| SS | 6 | 700 |
| Chromium | 0.03 | 3.5 |
| Phenolics | 0.03 | 3.5 |
| Sulfides | 0.06 | 7.0 |

Currently the BOD load discharged exceeded the guidelines by almost three times (1,970 lb/day). The recommended sulfide load was exceeded by more than, in order to maintain a minimum DO concentration in the Holston River, 30 times (220 lb/day). In addition the 1969 FWQA survey, concluded that, in order to maintain a minimum DO concentration in the Holston River, the maximum BOD load not exceed 260 lb/day, substantially less than suggested in the guidelines. To maintain a minimum DO concentration of 5.0 mg/1, it is estimated that the maximum BOD discharge should not be greater than 150 lb/day.

To obtain this lower limit will require at least a 92 percent reduction of the BOD load discharged during the survey. Effluent limits that this mill must meet are as follows:

| | | |
|---|---|---|
| 1. | BOD | 150 lb/day or 1.4 lb/1,000 lb of product |
| 2. | Suspended Solids | 150 lb/day or 1.4 lb/1,000 lb of product (above background levels) |
| 3. | Chromium | 3.5 lb/day or 0.03 lb/1,000 lb of product |
| 4. | Phenolics | 3.5 lb/day or 0.03 lb/1,000 lb of product |
| 5. | Sulfides | 7.0 lb/day or 0.06 lb/1,000 lb of product |

These limits can only be met by segregating cooling water and process water and the installation of additional treatment that must employ, as a minimum, best practicable control technology. A routine monitoring and sampling program will be necessary to ensure compliance with these effluent limits.

In order to improve the treatment afforded by the present system the company will have to clean out the lagoons. The lagoons will have to also be sealed to prevent excessive seepage.

## H. ASG INDUSTRIES, INC.

### Waste-Source Evaluation

ASG Industries produces 198 tons/day of rolled glass, polished wire glass and miscellaneous flat glass including tempered and laminated glass. There are two discharges to the South Fork of the Holston River. A RAPP Application has been filed for both discharges.

The cooling-water discharge (Station 39, RM 142.15/4.35) receives surface run-off and cooling and rinse water from a glass-washing operation and flows directly to the river. The other discharge (Station 37, RM 142.15/4.04) contains wastewater from the grinding and polishing operation, specialty coating operation, and washer rinse-water, all of which is treated. The treatment system basically consists of a thickener (alum coagulation[*]) with thickened sludge dewatered by vacuum filtration. At the time of the initial plant visit (10 November 1972) the effluent had a deep red color and appeared to have a high concentration of suspended solids. This effluent joins a milky white stream of rinse water from other washers and flows into an open ditch located on the Holston Army Ammunition Plant (Area A). It mixes with Area-A wastewaters before being discharged into the South Fork for both discharges.

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[*] Alum is dumped in the center of the clarifier. No attempt is made to mix it with the wastewater nor to allow time for the floc to settle.

EPA personnel performed jar tests on the influent stream to the clarifier. They revealed that the suspended solids could be reduced to approximately 20 mg/l by the addition of an anionic polymer and ferric sulfate and by maintaining the pH at 7.0. During the survey the clarifier effluent averaged 843 mg/l of suspended solids. The discharge (0.52 mgd) had a COD load of 179 lb/day and contained 3,600 lb/day of suspended solids and had a pH ranging from 6.5 to 10.9. The cooling water flow was 1.2 mgd and contained 460 lb of suspended solids; the oil and grease ranged from 4 to 7 mg/l.

## Treatment Needs

According to EPA interim Effluent Guidelines for the Cement, Lime, Gypsum, Asbestos and Flat-Glass Industries (21 September 1972) a typical process- and cooling-water stream for a plant of this type would be approximately 0.1 mgd. Effluent limitations for the total plant discharge are as follows:

| Parameter | lb/1,000 Tons Finished Product | lb/day (This Size Plant) | Actual Load (lb/day) Discharged During Survey |
|---|---|---|---|
| Suspended Solids | 34 | 16.6 | 4,060 |
| COD | 84 | 16.6 | 179 |

The guidelines also stipulate that no more than 4.2 lb of hexane extractables (oil and grease) and total phosphorus be generated for each 1,000 tons of glass produced. During the survey ASG discharged more than 200 times the recommended limit of suspended solids and 10 times the COD limit. The oil and grease detected in Station 39 should not be present in an uncontaminated cooling-water stream.

To achieve effective pollution control at ASG the cooling- and waste-water streams should be segregated, with the latter being routed to the treatment system. Conservation and re-use of waters within the plant are other steps that can be taken to reduce treatment costs.

By employing the best practicable control technology currently available, ASG should meet the proposed effluent limitations by 1 July 1974. A monitoring and sampling program is necessary to ensure compliance with the effluent limits and protection of the receiving waters.

## I. PENN-DIXIE CEMENT CORPORATION

### Waste-Source Evaluation

The Penn-Dixie plant produces an average of 900 tons/day of cement. There are two waste streams that discharge to the South Fork of the Holston River: the untreated cooling-water stream (Station 47, RM 142.15/2.6) and the process-waste stream from the air-solids waste treatment system (Station 48, RM 142.15/2.7). A RAPP application has been filed for the latter discharge only.

The treatment system is employed to remove soluble alkalies from the stack dust before the dust is recirculated back to the kiln. Briefly, the dust from the kiln stack precipitator is slurried with water and then thickened in a settler from which the sludge is returned to the kiln. The overflow is carbonated, to reduce the pH, and clarified: the clarifier sludge is then returned to the thickener while the overflow is recarbonated and discharged to the river [Figure E-7].

Penn-Dixie discharged a total flow of 0.78 mgd containing 1,800 lb of suspended solids/day (362 lb/1,000 bbl). Ninty-six percent of this suspended-solids loading is contained in the cooling-water discharges (0.49 mgd).

Treatment Needs

The EPA interim Effluent Guidelines recommend the following limitations for a cement plant:

| Parameter | lbs/day 1,000 bbl produced | lb/day (plant this kind) |
|---|---|---|
| Suspended Solids | 7 | 35 |
| COD | 7 | 35 |

The process-waste stream contained almost twice this recommended suspended-solids load; the uncontaminated cooling water stream contained 50 times this amount.

In addition, data from the RAPP application and the State of Tennessee Appendix E, indicate that the solids concentration in the process-waste stream normally exceeds the levels found at the time of the survey. The guidelines also estimate that a plant of this kind would have a waste flow of 0.14 mgd (27,000 gal/1,000-bbl production), roughly one sixth the flow presently being discharged by Penn-Dixie.

In accordance with the best applicable control technology currently available the guidelines are based upon minimum water usage, its time of contact with leachable substances, and upon the elimination of frequent and unnecessary spillage, overflows, and inefficient washing methods.

To achieve effective pollution control Penn-Dixie must conserve and re-use wastewater within the plant and isolate and treat the source of suspended solids in the cooling-water stream. A monitoring and sampling program, of sufficient detail to ensure that the effluent limits are met and that receiving-water quality is protected, should be a requirement of the permit.

## J. J. P. STEVENS AND COMPANY, INC.--BORDEN PLANT

The Borden Plant converts approximately 54,000 lb/day of baled cotton to greige (untreated condition, just as it comes from the loom) - cotton fabric by cording, spinning, and weaving. A RAPP application was not filed because all wastewater flows are sent to the municipal sewer system. However, dye studies, conducted 1 December 1972, indicated that the Borden Plant wastewater was being discharged to the South Fork of the Holston River (Station RM 142.15/4.31). Inspection of the sewer line revealed that trash and debris had blocked the interceptor line, located on Lincoln Street, where the J. P. Stevens wastes enter the municipal sewer. This condition was corrected 6 December 1972. The characteristics indicated that the flow contained domestic wastes.

To prevent the occurrence of by-passing within the sewerage system it has been recommended that the City develop a routing sewer maintenance program [Appendix E, Section E].

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A-1

# APPENDIX A

# GENERAL WATER QUALITY CRITERIA
# FOR THE DEFINITION AND CONTROL OF POLLUTION
# IN THE WATERS OF TENNESSEE

# GENERAL WATER QUALITY CRITERIA FOR THE DEFINITION AND CONTROL OF POLLUTION IN THE WATERS OF TENNESSEE

Adopted on May 26, 1967
Amended on November 17, 1967, May 22, 1970, October 26, 1971, and
December 14, 1971

## Tennessee Water Quality Control Board*

The Water Quality Control Act of 1971, Chapter 164 Public Acts of 1971 as Amended by Chapter 386, makes it the duty of the Water Quality Control Board to study and investigate all problems concerned with the pollution of the waters of the State and with its prevention, abatement, and control and to establish such standards of quality for any waters of the State in relation to their reasonable and necessary use as the Board shall deem to be in the public interest and establish general policies relating to existing or proposed future pollution as the Board shall deem necessary to accomplish the purpose of the Control Act. The following general considerations and criteria are officially adopted by the Board as a guide in determining the permissible conditions of waters with respect to pollution and the preventive or corrective measures required to control pollution in various waters or in different sections of the same waters.

## GENERAL CONSIDERATIONS

1. Waters have many uses which in the public interest are reasonable and necessary. Such uses include: sources of water supply for domestic and industrial purposes; propagation and maintenance of fish and other desirable aquatic life; recreational boating and fishing; the final disposal of municipal sewage and industrial waste following adequate treatment; stock watering and irrigation; navigation; generation of power; and the enjoyment of scenic and esthetic qualities of the waters.

2. The rigid application of uniform water quality is not desirable or reasonable because of the varying uses of such waters. The assimilative capacity of a stream for sewage and waste varies depending upon various factors including the following: volume of flow, depth of channel, the presence of falls or rapids, rate of flow, temperature, natural characteristics, and the nature of the stream. Also the relative importance assigned to each use will differ for different waters and sections of waters throughout the stream.

3. To permit reasonable and necessary uses of the waters of the State, existing pollution should be corrected as rapidly as practical and future pollution controlled by treatment plants or other measures. There is an economical balance between the cost of sewage and waste treatment and the benefits received. Within permissible limits, the dilution factor and the assimilative capacity of surface water should be utilized. Waste recovery, control of rates and dispersion of waste into the streams, and control of rates and characteristics of flow of waters in the stream where adequate, will be considered to be a means of correction.

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* Fully Approved on June 2, 1972, by the Environmental Protection Agency.

4. Sewage, industrial wastes, or other wastes, as defined in The Water Quality Control Act of 1971, Chapter 164 Public Acts of 1971, as amended by Chapter 386, shall not be discharged into or adjacent to streams or other surface waters in such quantity and of such character or under such conditions of discharge in relation to the receiving waters as will result in visual or olfactory nuisances, undue interference to other reasonable and necessary uses of the water, or appreciable damage to the natural processes of self-purification. In relation to the various qualities and the specific uses of the receiving waters, no sewage, industrial wastes, or other wastes discharged shall be responsible for conditions that fail to meet the criteria of water quality outlined below. Bypassing or accidental spills will not be tolerated.

   The criteria of water quality outlined below are considered as guides in applying the water quality objectives in order to insure reasonable and necessary uses of the waters of the State. In order to protect the public health and maintain the water suitable for other reasonable and necessary uses; to provide for future development; to allow proper sharing of available water resources; and to meet the needs of particular situations, additional criteria will be set.

CRITERIA OF WATER CONDITIONS

1. Domestic Raw Water Supply

   (a) Dissolved Oxygen - There shall always be sufficient dissolved oxygen present to prevent odors of decomposition and other offensive conditions.

   (b) pH - The pH value shall lie within the range of 6.0 to 9.0 and shall not fluctuate more than 1.0 unit in this range over a period of 24 hours.

   (c) Hardness or Mineral Compounds - There shall be no substances added to the waters that will increase the hardness or mineral content of the waters to such an extent to appreciably impair the usefulness of the water as a source of domestic water supply.

   (d) Total Dissolved Solids - The total dissolved solids shall at no time exceed 500 mg/l.

   (e) Solids, Floating Materials and Deposits - There shall be no distinctly visible solids, scum, foam, oily sleek, or the formation of slimes, bottom deposits or sludge banks of such size or character as may impair the usefulness of the water as a source of domestic water supply.

   (f) Turbidity or Color - There shall be no turbidity or color added in amounts or characteristics that can not be reduced to acceptable concentrations by conventional water treatment processes.

(g) Temperature - The maximum water temperature change shall not exceed 3C° relative to an upstream control point. The temperature of the water shall not exceed 30.5°C and the maximum rate of change shall not exceed 2C° per hour. The temperature of impoundments where stratification occurs will be measured at a depth of 5 feet, or mid-depth whichever is less, and the temperature in flowing streams shall be measured at mid-depth.

(h) Microbiological Coliform - Coliform group shall not exceed 10,000 per 100 ml. as a monthly average value (either MPN or MF count); nor exceed this number in more than 20 per cent of the samples examined during any month; nor exceed 20,000 per 100 ml. in more than five per cent of such samples. These values may be exceeded provided the organisms are known to be of nonfecal origin. No disease producing bacteria or other objectionable organisms shall be added to surface waters which will result in the contamination of said waters to such an extent as to render the water unsuitable as sources of domestic water supply after conventional water treatment.

(i) Taste or Odor - There shall be no substances added which will result in taste or odor that prevent the production of potable water by conventional water treatment processes.

(j) Toxic Substances - There shall be no toxic substances added to the waters that will produce toxic conditions that materially affect man or animals or impair the safety of a conventionally treated water supply.

(k) Other Pollutants - Other pollutants shall not be added to the water in quantities that may be detrimental to public health or impair the usefulness of the water as a source of domestic water supply.

2. Industrial Water Supply.

(a) Dissolved Oxygen - There shall always be sufficient dissolved oxygen present to prevent odors of decomposition and other offensive conditions.

(b) pH - The pH value shall lie within the range of 6.0 to 9.0 and shall not fluctuate more than 1.0 unit in this range over a period of 24 hours.

(c) Hardness or Mineral Compounds - There shall be no substances added to the waters that will increase the hardness or mineral content of the waters to such an extent as to appreciably impair the usefulness of the water as a source of industrial water supply.

(d) Total Dissolved Solids - The total dissolved solids shall at no time exceed 500 mg/l.

(e) Solids, Floating Materials and Deposits - There shall be no distinctly visible solids, scum, foam, oily sleek, or the formation of slimes, bottom deposits or sludge banks of such size or character as may impair the usefulness of the water as a source of industrial water supply.

(f) Turbidity or Color - There shall be no turbidity or color added in amounts or characteristics that can not be reduced to acceptable concentrations by conventional water treatment processes.

(g) Temperature - The maximum water temperature change shall not exceed 3C° relative to an upstream control point. The temperature of the water shall not exceed 30.5°C and the maximum rate of change shall not exceed 2C° per hour. The temperature of impoundments where stratification occurs will be measured at a depth of 5 feet, or mid-depth whichever is less, and the temperature in flowing streams shall be measured at mid-depth.

(h) Taste or Odor - There shall be no substances added that will result in taste or odor that would prevent the use of the water for industrial processing.

(i) Toxic Substances - There shall be no substances added to the waters that may produce toxic conditions that will adversely affect the water for industrial processing.

(j) Other Pollutants - Other pollutants shall not be added to the waters in quantities that may adversely affect the water for industrial processing.

3. Fish and Aquatic Life.

(a) Dissolved Oxygen - The dissolved oxygen shall be maintained at 5.0 mg/l except in limited sections of the stream receiving treated effluents. In these limited sections, a minimum of 3.0 mg/l dissolved oxygen shall be allowed. The dissolved oxygen content shall be measured at mid-depth in waters having a total depth of ten (10) feet or less and at a depth of five (5) feet in waters having a total depth of greater than ten (10) feet. A minimum dissolved oxygen content of 6.0 mg/l shall be maintained in recognized trout streams.

(b) pH - The pH value shall lie within the range of 6.5 to 8.5 and shall not fluctuate more than 1.0 unit in this range over a period of 24 hours.

(c) Solids, Floating Materials and Deposits - There shall be no distinctly visible solids, scum, foam, oily sleek, or the formation of slimes, bottom deposits or sludge banks of such size or character that may be detrimental to fish and aquatic life.

(d) Turbidity or Color - There shall be no turbidity or color added in such amounts or of such character that will materially affect fish and aquatic life.

(e) Temperature - The maximum water temperature change shall not exceed 3C° relative to an upstream control point. The temperature of the water shall not exceed 30.5°C and the maximum rate of change shall not exceed 2C° per hour. The temperature of recognized trout waters shall not exceed 20°C. There shall be no abnormal temperature changes that may affect aquatic life unless caused by natural conditions. The temperature of impoundments where stratification occurs will be measured at a depth of 5 feet, or mid-depth whichever is less, and the temperature in flowing streams shall be measured at mid-depth.

(f) Taste or Odor - There shall be no substances added that will impart unpalatable flavor to fish or result in noticeable offensive odors in the vicinity of the water or otherwise interfere with fish or aquatic life.

(g) Toxic Substances - There shall be no substances added to the waters that will produce toxic conditions that affect fish or aquatic life.

(h) Other Pollutants - Other pollutants shall not be added to the waters that will be detrimental to fish or aquatic life.

4. Recreation.

(a) Dissolved Oxygen - There shall always be sufficient dissolved oxygen present to prevent odors of decomposition and other offensive conditions.

(b) pH - The pH value shall lie within the range of 6.0 to 9.0 and shall not fluctuate more than 1.0 unit in this range over a period of 24 hours.

(c) Solids, Floating Materials and Deposits - There shall be no distinctly visible solids, scum, foam, oily sleek, or the formation of slimes, bottom deposits or sludge banks of such size or character that may be detrimental to recreation.

(d) Turbidity or Color - There shall be no turbidity or color added in such amounts or character that will result in an objectionable appearance to the water.

(e) Temperature - The maximum water temperature change shall not exceed 3C° relative to an upstream control point. The temperature of the water shall not exceed 30.5°C and the maximum rate of change shall not exceed 2C° per hour. The temperature of impoundments where stratification occurs will be measured at a depth of 5 feet, or mid-depth whichever is less, and the temperature in flowing streams shall be measured at mid-depth.

(f) Microbiological Coliform - The fecal coliform group shall not exceed 5,000 per 100 ml. as a monthly average value nor exceed this number in more than 20 per cent of the samples examined during any month nor exceed 20,000 per 100 ml. in more than five per cent of such samples. In those waters that are physically suitable and available to the public for water-contact recreation the fecal coliform concentration shall not exceed 1,000 per 100 ml. in any two consecutive samples collected during the months of May through September. Water areas near outfalls of domestic sewage treatment plants are not considered suitable for water-contact recreation.

(g) Taste or Odor - There shall be no substances added that will result in objectionable taste or odor.

(h) Toxic Substances - There shall be no substances added to the water that will produce toxic conditions that affect man or animal.

(i) Other Pollutants - Other pollutants shall not be added to the water in quantities which may have a detrimental effect on recreation.

5. Irrigation

(a) Dissolved Oxygen - There shall always be sufficient dissolved oxygen present to prevent odors of decomposition and other offensive conditions.

(b) pH - The pH value shall lie within the range of 6.0 to 9.0 and shall not fluctuate more than 1.0 unit in this range over a period of 24 hours.

(c) Hardness or Mineral Compounds - There shall be no substances added to the water that will increase the mineral content to such an extent as to impair its use for irrigation.

(d) Solids, Floating Materials and Deposits - There shall be no distinctly visible solids, scum, foam, oily sleek, or the formation of slimes, bottom deposits or sludge banks of such size or character as may impair the usefulness of the water for irrigation purposes.

(e) Temperature - The temperature of the water shall not be raised or lowered to such an extent as to interfere with its use for irrigation purposes.

(f) Toxic Substances - There shall be no substances added to water that will produce toxic conditions that will affect the water for irrigation.

(g) Other Pollutants - Other pollutants shall not be added to the water in quantities which may be detrimental to the waters used for irrigation.

6. Livestock Watering and Wildlife

(a) Dissolved Oxygen - There shall always be sufficient dissolved oxygen present to prevent odors of decomposition and other offensive conditions.

(b) pH - The pH value shall lie within the range of 6.0 to 9.0 and shall not fluctuate more than 1.0 unit in this range over a period of 24 hours.

(c) Hardness or Mineral Compounds - There shall be no substances added to water that will increase the mineral content to such an extent as to impair its use for livestock watering and wildlife.

(d) Solids, Floating Materials and Deposits - There shall be no distinctly visible solids, scum, foam, oily sleek, or the formation of slimes, bottom deposits or sludge banks of such size or character as to interfere with livestock watering and wildlife.

(e) Temperature - The temperature of the water shall not be raised or lowered to such an extent as to interfere with its use for livestock watering and wildlife.

(f) Toxic Substances - There shall be no substances added to water that will produce toxic conditions that will affect the water for livestock watering and wildlife.

(g) Other Pollutants - Other pollutants shall not be added to the water in quantities which may be detrimental to the water for livestock watering and wildlife.

7. Navigation

(a) Dissolved Oxygen - There shall always be sufficient dissolved oxygen present to prevent odors of decomposition and other offensive conditions.

(b) Hardness or Mineral Compounds - There shall be no substances added to the water that will increase the mineral content to such an extent as to impair its use for navigation.

(c) Solids, Floating Materials and Deposits - There shall be no distinctly visible solids, scum, foam, oily sleek, or the formation of slimes, bottom deposits or sludge banks of such size or character as to interfere with navigation.

(d) Temperature - The temperature of the water shall not be raised or lowered to such an extent as to interfere with its use for navigation purposes.

(e) Toxic Substances - There shall be no substances added to water that will produce toxic conditions that will affect the water for navigation.

(f) Other Pollutants - Other pollutants shall not be added to the water in quantities which may be detrimental to the waters used for navigation.

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These criteria should not be construed as permitting the degradation of higher quality water when such can be prevented by reasonable pollution control measures. The above conditions are recognized as applying to waters affected by the discharge of sewage and/or industrial waste or other waste and not resulting from natural causes.

## DEFINITIONS

1. Conventional Water Treatment - Conventional water treatment as referred to in the criteria denotes coagulation, sedimentation, filtration and chlorination.

2. Mixing Zone - Mixing zone refers to that section of flowing stream or impounded waters necessary for effluents to become dispersed.

   The mixing zone necessary in each particular case shall be defined by the Tennessee Water Quality Control Board.

## INTERPRETATION OF CRITERIA

1. Interpretations of the above criteria shall conform to any rules and regulations or policies adopted by the Water Quality Control Board.

2. Insofar as practicable, the effect of treated sewage or waste discharges on the receiving waters shall be considered after they are mixed with the waters and beyond a reasonable zone of immediate effect upon the qualities of the waters. The extent to which this is practicable depends upon local conditions and the proximity and nature of other uses of the waters.

3. The technical and economical feasibility of waste treatment, recovery, or adjustment of the method of discharge to provide correction shall be considered in determining the time to be allowed for the development of practicable methods and for the specified correction.

4. The criteria set forth shall be applied on the basis of the following stream flows: unregulated streams - stream flows equal to or exceeding the 3-day minimum, 20-year recurrence interval; regulated streams - instantaneous minimum flow.

5. In general, deviations from normal water conditions may be undesirable, but the rate and extent of the deviations should be considered in interpreting the above criteria.

6. The criteria and standards provide that all discharges of sewage, industrial waste, and other wastes will receive the best practicable treatment (secondary or the equivalent) or control according to the policy and procedure of the Tennessee Water Quality Control Board. A degree of treatment greater than secondary when necessary to protect the water uses will be required for selected sewage and waste discharges.

TENNESSEE ANTIDEGRADATION STATEMENT

1. The Standards and Plan adopted are designed to provide for the protection of existing water quality and/or the upgrading or "enhancement" of water quality in all waters within Tennessee. It is recognized that some waters may have existing quality better than established standards.

2. The Criteria and Standards shall not be construed as permitting the degradation of these higher quality waters when such can be prevented by reasonable pollution control measures. In this regard, existing high quality water will be maintained unless and until it is affirmatively demonstrated to the Tennessee Water Quality Control Board that a change is justifiable as a result of necessary social and economic development.

3. All discharges of sewage, industrial waste, or other waste shall receive the best practicable treatment (secondary or the equivalent) or control according to the policy and procedure of the Tennessee Water Quality Control Board. A degree of treatment greater than secondary when necessary to protect the water uses will be required for selected sewage and waste discharges.

4. In implementing the provisions of the above as they relate to interstate streams, the Tennessee Water Quality Control Board will cooperate with the appropriate Federal Agency in order to assist in carrying out responsibilities under the Federal Water Pollution Control Act, as amended.

December 17, 1971

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WINFIELD DUNN
Governor

Eugene W. Fowinkle, M.D., M.P.H.
Commissioner

STATE OF TENNESSEE
DEPARTMENT OF PUBLIC HEALTH
NASHVILLE 37219

April 2, 1973

CERTIFIED MAIL

Lt. Colonel F. L. Reid, Jr.
Holston Army Ammunition Plant
P. O. Box 749
Kingsport, Tennessee 37662

Re: Wastewater Discharge
Holston Army Ammunition Plant
Kingsport, Tennessee

Dear Lt. Colonel Reid:

The purpose of this correspondence is to acknowledge and confirm the subject of our meeting held at the Holston Army Ammunition Plant on March 14, 1973.

As you know, this Division has established effluent standards necessary to prevent the pollution of the Holston River and the South Fork Holston River in the Kingsport area. As discussed in the meeting, specific effluent criteria for the above referenced discharge have now been established and will be contained in this letter.

In establishing the required effluent criteria, this Divison has addressed itself toward determining the levels of certain parameters that may be present in the river without violating the uses for which the river has been classified. The waters in the Holston River and the South Fork Holston River, at present, will not meet the criteria for the classified uses. The effluent limits as established herein for certain parameters have been calculated and so proportioned among the "major" dischargers, including both Holston Army Ammunition Plants "A" and "B", that it would be expected that the waters would be improved to the extent that they would not violate the classified uses. These effluent criteria are as follows:

Holston Army Ammunition Plant "A"

I. The following parameters show limitations which apply to net contribution of all wastewater discharges. Each discharge point requires a separate Permit by the State of Tennessee. A Permit will state that the limitation for each of the following parameters will apply for the particular discharge, either singularly or in combination with all other discharges.

1. The total five (5) day, 20°C biochemical oxygen demand contributed by all discharges from the Holston Army Ammunition Plant/Holston Defense Corporation Area "A", as measured by the combined differences in each intake and each discharge, must not exceed 1,050 pounds per day.
2. The total contribution of total kjeldahl nitrogen of all discharges from the Holston Army Ammunition Plant/Holston Defense Corporation Area "A", as measured by the combined differences in each intake and each discharge, must not exceed 10 pounds per day.
3. The total contribution of total nitrogen of all discharges from the Holston Army Ammunition Plant/Holston Defense Corporation Area "A", as measured by the combined differences in each intake and each discharge, must not exceed 10 pounds per day.
4. The total contribution of ammonia nitrogen, as N, of all discharges from the Holston Army Ammunition Plant/Holston Defense Corporation Area "A", as measured by the combined differences in each intake and each discharge, must not exceed 10 pounds per day.
5. The total contribution of nitrates plus nitrites of all discharges from the Holston Army Ammunition Plant/Holston Defense Corporation Area "A" as measured by the combined differences in each intake and each discharge, must not exceed 10 pounds per day.
6. The total contribution of phosphorus, as P, of all discharges from the Holston Army Ammunition Plant/Holston Defense Corporation Area "A", as measured by the combined differences in each intake and each discharge, must not exceed 172 pounds per day.
7. The total contribution of total dissolved solids of all discharges from the Holston Army Ammunition Plant/Holston Defense Corporation Area "A", as measured by the combined differences in each intake and each discharge, must not exceed 100.000 pounds per day.
8. The total contribution of phenols of all discharges from the Holston Army Ammunition Plant/Holston Defense Corporation Area "A", as measured by the combined differences in each intake and each discharge, must not exceed 10 pounds per day.

II. The following parameters show limitations in concentration which apply to each and every discharge point.

1. The daily average concentration of suspended solids in the wastewater must not exceed 40 mg/1.
2. The instantaneous maximum concentration of suspended solids in the wastewater must not exceed 50 mg/1.
3. The daily average concentration of total chromium in the wastewater discharge must not exceed 0.05 mg/1.
4. The instantaneous maximum concentration of total chromium in the wastewater discharge must not exceed 0.075 mg/1.
5. The daily average concentration of copper in the wastewater discharge must not exceed 0.02 mg/1.
6. The instantaneous maximum concentration of copper in the wastewater discharge must not exceed 0.03 mg/1.
7. The daily average concentration of mercury in the wastewater discharge must not exceed 0.005 mg/1.
8. The instantaneous maximum concentration of mercury in the wastewater discharge must not exceed 0.0075 mg/1.
9. The daily average concentration of lead in the wastewater discharge must not exceed 0.05 mg/1.
10. The instantaneous maximum concentration of lead in the wastewater discharge must not exceed 0.075 mg/1.
11. The dissolved oxygen concentration in the final effluent must be greater than 5.0 mg/1.
12. The concentration of settleable solids in the wastewater discharge must not exceed 0.5 ml/1 as measured by the standard one-hour Imhoff cone test.
13. The pH of the wastewater discharge must not be less than 6.0 nor greater than 9.0.
14. The wastewater must contain no distinctly visible floating scum, oil, or other floating matter.

15. There shall be no objectionable color change in the receiving stream resulting from the wastewater discharge.

16. This discharge must not cause a water temperature change in the South Fork Holston River or Holston River of more than 3°C relative to an upstream control point. Also, the discharge must be such that the water temperature of the South Fork Holston River or Holston River does not exceed 30.5°C (except as a result of natural causes) and the discharge must be such that the maximum rate of temperature change in the South Fork Holston River or Holston River does not exceed 2°C per hour (except as a result of of natural causes).

## Holston Army Ammunition Plant "B"

I. The following parameters show limitations which apply to net contribution of all wastewater discharges. Each discharge point requires a separate Permit by the State of Tennessee. A Permit will state that the limitation for each of the following parameters will apply for the particular discharge, either singularly or in combination with all other discharges.

1. The total five (5) day, 20°C biochemical oxygen demand contributed by all discharges from the Holston Army Ammunition Plant/Holston Defense Corporation Area "B", as measured by the combined differences in each intake and each discharge, must not exceed 1,430 pounds per day.

2. The total contribution of total kjeldahl nitrogen of all discharges from the Holston Army Ammunition Plant/Holston Defense Corporation Area "B", as measured by the combined differences in each intake and each discharge, must not exceed 76 pounds per day.

3. The total contribution of total nitrogen of all discharges from the Holston Army Ammunition Plant/Holston Defense Corporation Area "B", as measured by the combined differences in each intake and each discharge, must not exceed 620 pounds per day.

4. The total contribution of ammonia nitrogen, as N, of all discharges from the Holston Army Ammunition Plant/Holston Defense Corporation Area "B", as measured by the combined differences in each intake and each discharge, must not exceed 76 pounds per day.

5. The total contribution of nitrates plus nitrites of all discharges from the Holston Army Ammunition Plant/Holston Defense Corporation Area "B" as measured by the combined differences in each intake and each discharge, must not exceed 556 pounds per day.

6. The total contribution of phosphorus, as P, of all discharges from the Holston Army Ammunition Plant/Holston Defense Corporation Area "B", as measured by the combined differences in each intake and each discharge must not exceed 213 pounds per day.

7. The total contribution of total dissolved solids of all discharges from the Holston Army Ammunition Plant/Holston Defense Corporation Area "B", as measured by the combined differences in each intake and each discharge, must not exceed 500,000 pounds per day.

8. The total contribution of phenols of all discharges from the Holston Army Ammunition Plant/Holston Defense Corporation Area "B", as measured by the combined differences in each intake and each discharge, must not exceed 10 pounds per day.

II. The following parameters show limitations in concentrations which apply to each and every discharge point.

1. The daily average concentration of suspended solids in the wastewater must not exceed 40 mg/l.

2. The instantaneous maximum concentration of suspended solids in the wastewater must not exceed 50 mg/l.

3. The daily average concentration of total chromium in the wastewater discharge must not exceed 0.05 mg/l.

4. The instantaneous maximum concentration of total chromium in the wastewater discharge must not exceed 0.075 mg/l.

5. The daily average concentration of copper in the wastewater discharge must not exceed 0.02 mg/l.

6. The instantaneous maximum concentration of copper in the the wastewater discharge must not exceed 0.03 mg/l.

7. The daily average concentration of mercury in the wastewater discharge must not exceed 0.005 mg/l.

8. The instantaneous maximum concentration of mercury in the wastewater discharge must not exceed 0.0075 mg/l.

9. The daily average concentration of lead in the wastewater discharge must not exceed 0.05 mg/l.

10. The instantaneous maximum concentration of lead in the wastewater discharge must not exceed 0.075 mg/l.

11. The dissolved oxygen concentration in the final effluent must be greater than 5.0 mg/l.

12. The concentration of settleable solids in the wastewater discharge must not exceed 0.5 ml/l as measured by the standard one-hour Imhoff cone test.

13. The pH of the wastewater discharge must not be less than 6.0 nor greater than 9.0.

14. The wastewater must contain no distinctly visible floating scum, oil, or other floating matter.

15. There shall be no objectionable clolor change in the receiving stream resulting from the wastewater discharge.

16. This discharge must not cause a water temperature change in the Holston River of more than 3°C relative to an upstream control point. Also, the discharge must be such that the water temperature of the Holston River does not exceed 30.5°C (except as a result of natural causes) and the discharge must be such that the maximum rate of temperature change in the Holston River does not exceed 2°C per hour (except as a result of natural causes).

According to our records, the referenced discharges will not at this time meet the above standards. It will, therefore, be necessary that additional treatment facilities or other alterations resulting in substantial wastewater characterization changes are in order.

As we discussed in the meeting, the Holston Army Ammunition Plants are not making formal application for a wastewater discharge Permit due to certain policy regulations promulgated by the Department of Army. For this reason and since it is necessary for the Division to hold an enforceable document outlining an implementation schedule for pollution abatement, the Division will recommend that a Commissioner's Order be issued. This Commissioner's Order will contain the effluent criteria as outlined above and an implementation schedule which is to be provided to this Division by the Holston Army Ammunition Plant on or before May 4, 1973. As we discussed, the schedule should represent a rapid approach to the solution of this problem and should include dates for:

1. Submittal of an engineering report;
2. Submittal of final plans and specifications;
3. Initiation of construction;
4. Completion of construction;
5. Treatment facilities to be in satisfactory operation: and
6. Any additional interim dates as deemed by HAAP.

Upon receipt of this schedule, it will be reviewed by engineers of this Division. At that time, any revisions deemed necessary by this Division will be made.

Within two weeks of the date of receipt of this schedule, pursuant to TCA Section 70-331 (a) made applicable to you by 33 USC 1323, this Division will recommend to the Commissioner of the Department of Public Health that an Order be issued as early as possible.

## STATE OF TENNESSEE STANDARDS*

## TENNESSEE EASTMAN COMPANY

I. The following parameters show limitations which apply to net contribution of all wastewater discharges. Each discharge point requires a separate Permit by the State of Tennessee. A Permit will state that the limitation for each of the following parameters will apply for the particular discharge, either singularly or in combination with all other discharges.

1. The total five (5) day, 20°C biochemical oxygen demand contributed by all discharges from the Tennessee Eastman Company, as measured by the combined differences in each intake and each discharge, must not exceed 3,350 pounds per day.

2. The total contribution of total kjeldahl nitrogen of all discharges from Tennessee Eastman Company, as measured by the combined differences in each intake and each discharge, must not exceed 400 pounds per day.

3. The total contribution of total nitrogen of all discharges from Tennessee Eastman Company, as measured by the combined differences in each intake and each discharge, must not exceed 3,310 pounds per day.

4. The total contribution of ammonia nitrogen, as N, of all discharges from Tennessee Eastman Company, as measured by the combined differences in each intake and each discharge, must not exceed 400 pounds.

5. The total contribution of nitrates plus nitrites of all discharges from Tennessee Eastman Company, as measured by the combined differences in each intake and each discharge, must not exceed 2,910 pounds.

6. The total contribution of phosphorus, as P, of all discharges from Tennessee Eastman Company, as measured by the combined differences in each intake and each discharge, must not exceed 213 pounds per day.

7. The total contribution of total dissolved solids, of all discharges from Tennessee Eastman Company, as measured by the combined differences in each intake and each discharge, must not exceed 1,200,000 pounds per day.

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* These effluent standards are for use in temporary state permits and have been confirmed by letter from the State of Tennessee to the individual companies.

8. The total contribution of zinc of all discharges from Tennessee Eastman Company, as measured by the combined differences in each intake and each discharge, must not exceed 250 pounds per day.

9. The total contribution of phenols of all discharges from Tennessee Eastman Company, as measured by the combined differences in each intake and each discharge must not exceed 100 pounds per day.

10. The total contribution of iron, as Fe, of all discharges from Tennessee Eastman Company, as measured by the combined differences in each intake and each discharge must not exceed 1,000 pounds per day.

II. The following parameters show limitations in concentrations which apply to each and every discharge point.

1. The daily average concentration of suspended solids in the wastewater must not exceed 40 mg/l.

2. The instantaneous maximum concentration of suspended solids in the wastewater must not exceed 50 mg/l.

3. The daily average concentration of total chromium in the wastewater discharge must not exceed 0.05 mg/l.

4. The instantaneous maximum concentration of total chromium in the wastewater discharge must not exceed 0.075 mg/l.

5. The daily average concentration of copper in the wastewater discharge must not exceed 0.02 mg/l.

6. The instantaneous maximum concentration of copper in the wastewater discharge must not exceed 0.03 mg/l.

7. The daily average concentration of mercury in the wastewater discharge must not exceed 0.005 mg/l.

8. The instantaneous maximum concentration of mercury in the wastewater discharge must not exceed 0.0075 mg/l.

9. The daily average concentration of lead in the wastewater discharge must not exceed 0.05 mg/l.

10. The instantaneous maximum concentration of lead in the wastewater discharge must not exceed 0.075 mg/l.

11. The dissolved oxygen concentration in the final effluent must be greater than 5.0 mg/l.

12. The concentration of settleable solids in the wastewater discharge must not exceed 0.5 ml/l as measured by the standard one-hour Imhoff cone test.

13. The pH of the wastewater discharge must not be less than 6.0 nor greater than 9.0.

14. The wastewater must contain no distinctly visible floating scum, oil or other floating matter.

15. There shall be no objectionable color change in the receiving stream resulting from the wastewater discharge.

16. This discharge must not cause a water temperature change in the South Fork Holston River or Holston River of more than 3°C relative to an upstream control point. Also, the discharge must be such that the water temperature of the South Fork Holston River or Holston River does not exceed 30.5°C (except as a result of natural causes) and the discharge must be such that the maximum rate of temperature change in the South Fork Holston River or Holston River does not exceed 2°C per hour (except as a result of natural causes).

# STATE OF TENNESSEE STANDARDS*

## CITY OF KINGSPORT

## SEWAGE TREATMENT PLANT

1. The concentration of settleable solids in the wastewater discharge must not exceed 0.1 ml/l as measured by the standard one-hour Imhoff cone test.

2. The pH of the wastewater discharge must not be less than 6.0 nor greater than 9.0.

3. The wastewater must contain no distinctly visible floating scum, oil, or other floating matter.

4. The daily average five (5) day, 20°C biochemical oxygen demand concentration in the wastewater discharge must not exceed 10 mg/l.

5. The instantaneous maximum five (5) day, 20°C biochemical oxygen demand concentration in the wastewater discharge must not exceed 15 mg/l.

6. The total five (5) day, 20°C biochemical oxygen demand concentration in the wastewater discharge must not exceed 500 pounds per day.

7. The daily average concentration of suspended solids in the wastewater must not exceed 15 mg/l.

8. The instantaneous maximum concentration of suspended solids in the wastewater must not exceed 20 mg/l.

9. The total suspended solids in the wastewater discharge must not exceed 1,250 pounds per day.

10. The daily average concentration of total kjeldahl nitrogen in the wastewater discharge must not exceed 1.6 mg/l.

11. The instantaneous maximum concentration of total kjeldahl in the wastewater discharge must not exceed 2.4 mg/l.

12. The total amount of total kjeldahl nitrogen in the wastewater discharge must not exceed 133 pounds per day.

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* These effluent standards are for use in temporary state permits and have been confirmed by letter from the State of Tennessee to the individual companies.

13. The daily average concentration of total nitrogen in the wastewater discharge must not exceed 1.8 mg/1.

14. The instantaneous maximum concentration of total nitrogen in the wastewater discharge must not exceed 2.7 mg/1.

15. The total amount of total nitrogen in the wastewater discharge must not exceed 150 pounds per day.

16. The daily average concentration of ammonia nitrogen in the wastewater discharge must not exceed 1.6 mg/1 as N.

17. The instantaneous maximum concentration of ammonia nitrogen in the wastewater discharge must not exceed 2.4 mg/1 as N.

18. The total amount of ammonia nitrogen in the wastewater discharge must not exceed 133 pounds per day as N.

19. The daily average concentration of nitrates plus nitrites in the wastewater discharge must not exceed 1.8 mg/1.

20. The instantaneous maximum concentration of nitrates plus nitrites in the wastewater discharge must not exceed 2.7 mg/1.

21. The total amount of nitrates plus nitrites in the wastewater discharge must not exceed 150 pounds per day.

22. The daily average concentration of phosphorus as P in the wastewater discharge must not exceed 1.0 mg/1.

23. The instantaneous maximum concentration of phosphorus as P in the wastewater discharge must not exceed 1.5 mg/1.

24. The total amount of phosphorus as P in the wastewater discharge must not exceed 85 pounds per day.

25. The wastewater discharge must have a chlorine residual between the limits of 0.2 mg/1 and 1.0 mg/1, and must be disinfected to the extent that viable coliform organisms are effectively eliminated.

26. The dissolved oxygen concentration in the final effluent must be greater than 5.0 mg/1.

## STATE OF TENNESSEE STANDARDS*

## MEAD CORPORATION

I. The following parameters show limitations which apply to net contributions of all wastewater discharges. Each discharge point requires a separate Permit by the State of Tennessee. A Permit will state that the limitation for each of the following parameters will apply for the particular discharge, either singularly or in combination with all other discharges.

1. The total five (5) day, 20°C biochemical oxygen demand contributed by all discharges from Mead Corporation, as measured by the combined differences in each intake and each discharge, must not exceed 1,100 pounds per day.
2. The total contribution of total kjeldahl nitrogen of all discharges from Mead Corporation, as measured by the combined differences in each intake and each discharge, must not exceed 60 pounds per day.
3. The total contribution of total nitrogen of all discharges from Mead Corporation, as measured by the combined differences in each intake and each discharge, must not exceed 60 pounds per day.
4. The total contribution of ammonia nitrogen, as N, of all discharges from Mead Corporation, as measured by the combined differences in each intake and each discharge, must not exceed 60 pounds per day.
5. The total contribution of nitrates plus nitrites of all discharges from Mead Corporation, as measured by the combined differences in each intake and each discharge, must not exceed 60 pounds per day.
6. The total contribution of phosphorus, as P, of all discharges from Mead Corporation, as measured by the combined differences in each intake and each discharge, must not exceed 85 pounds per day.
7. The total contribution of total dissolved solids, of all discharges from Mead Corporation, as measured by the combined differences in each intake and each discharge, must not exceed 200,000 pounds per day.
8. The total contribution of phenols of all discharges from Mead Corporation, as measured by the combined differences in each intake and each discharge, must not exceed 50 pounds per day.

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* These effluent standards are for use in temporary state permits and have been confirmed by letter from the State of Tennessee to the individual companies.

II. The following parameters show limitations in concentrations which apply to each and every discharge point:

1. The daily average concentration of suspended solids in the wastewater must not exceed 40 mg/1.
2. The instantaneous maximum concentration of suspended solids in the wastewater must not exceed 50 mg/1.
3. The daily average concentration of total chromium in the wastewater discharge must not exceed 0.05 mg/1.
4. The instantaneous maximum concentration of total chromium in the wastewater discharge must not exceed 0.075 mg/1.
5. The daily average concentration of copper in the wastewater discharge must not exceed 0.02 mg/1.
6. The instantaneous maximum concentration of copper in the wastewater discharge must not exceed 0.03 mg/1.
7. The daily average concentration of mercury in the wastewater discharge must not exceed 0.005 mg/1.
8. The instantaneous maximum concentration of mercury in the wastewater discharge must not exceed 0.0075 mg/1.
9. The daily average concentration of lead in the wastewater discharge must not exceed 0.05 mg/1.
10. The instantaneous maximum concentration of lead in the wastewater discharge must not exceed 0.075 mg/1.
11. The dissolved oxygen concentration in the final effluent must be greater than 5.0 mg/1.
12. The concentration of settleable solids in the wastewater discharge must not exceed 0.5 ml/1 as measured by the standard one-hour Imhoff cone test.
13. The pH of the wastewater discharge must not be less than 6.0 nor greater than 9.0.
14. The wastewater must contain no distinctly visible floating scum, oil, or other floating matter.

15. There shall be no objectionable color change in the receiving stream resulting from this wastewater discharge.

16. This discharge must not cause a water temperature change in the South Fork Holston River or Holston River of more than 3°C relative to an upstream control point. Also, the discharge must be such that the water temperature of the South Fork Holston River or Holston River does not exceed 30.5°C (except as a result of natural causes) and the discharge must be such that the maximum rate of temperature change in the South Fork Holston River or Holston River does not exceed 2°C per hour (except as a result of natural causes).

# APPENDIX B

# SAMPLING PROCEDURE

## SAMPLING PROCEDURE

Fifty-six sampling locations were established for the waste source and stream survey. These locations included direct discharges from seven industries to the Holston River and its tributaries, in-plant waste streams at Holston Mills, ASG Industries and Tennessee Eastman Company, and four stations in the Holston River.

The majority of the industrial waste samples were collected hourly by using automatic samplers and composited on an equal volume basis at the end of each 24-hour period. Where automatic samplers could not be used, samples were collected manually every two hours and composited on an equal volume basis.

Temperature, pH and conductivity were determined periodically. Samples were analyzed for solids, COD, TOC, nutrients, sulfates, organics, fluorides, metals and alkalinity. Grab samples for phenolic and oil and grease analyses were composited over a 4-6 hour period.

Samples for BOD, solids, phenolics, sulfide, color, alkalinity and oil and grease extractions were analyzed in the EPA mobile laboratory. COD, TOC, nutrients, sulfates, and fluoride analyses were performed at the NFIC laboratory in Cincinnati, Ohio. Organic samples were analyzed at the NFIC laboratories in Denver and Cincinnati.

Sediment samples were collected at stream stations 10-53, 54, and -56, using a Phleger core sampler. These samples were immediately packed with dry ice and shipped to the NFIC laboratory in Cincinnati for analyses.

Flow measurements were obtained from company records and flow meters, if available. Where necessary, EPA personnel installed flow measuring devices and recording equipment, or, if this was not possible, instantaneous flow measurements were taken using a Marsh-McBirney flow meter.

# APPENDIX C

## SAMPLE STATIONS

## SAMPLE STATIONS

| Figure Number | Station Number | Industry | River Mileage | Location and Type of Sampling |
|---|---|---|---|---|
| E-10 | 1 | HAAP "A" | 142.15/4.04 | Unnamed Creek, upstream of HAAP outfall discharges (grab) |
| E-10 | 2 | HAAP "A" | 142.15/4.04 | Main outfall stream (013)* at chain-link fence near river bank (composite) |
| E-10 | 3 | HAAP "A" | 142.15/4.30 | Process waste outfall (001) at manhole 8, prior to discharge (composite) |
| E-10 | 4 | HAAP "A" | 142.15/4.30 | Process waste and cooling water outfall (001) at manhole 7, prior to discharge (composite) |
| E-10 | 6 | HAAP "A" | 142.15/4.25 | Zeolite regeneration wastes and backwash (005) inside filter plant (grab depending on operation schedule) |
| E-10 | 7 | HAAP "A" | 142.15/4.24 | Process waste outfall (006) at outfall to river (composite) |
| E-10 | 8 | HAAP "A" | 142.15/4.20 | Leached wastes from tar-tank area (008) at discharge point near river bank (composite) |
| E-10 | 9 | HAAP "A" | 142.15/4.19 | Steam-plant effluent and floor drainage (009) at manhole steam plant (composite) |
| E-10 | 10 | HAAP "A" | 142.15/4.10 | Steam-plant and pump-house discharges (012) at sluice pit outfall (composite) |
| E-10 | 11 | HAAP "A" | 142.15/4.08 | Raw water intake at filter plant (grab) |
| E-8 | 12 | TEC | 142.15/4.50 | Hales Branch (001) effluent at TEC Sampler in Building 106 (composite) |

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* This designation is Refuse Act Permit Application discharge identification number.

## SAMPLE STATIONS (Cont.)

| Figure Number | Station Number | Industry | River Mileage | Location and Type of Sampling |
|---|---|---|---|---|
| E-8 | 13 | TEC | | Process waste to aerated lagoon at Building 250 lift station (composite) |
| E-8 | 14 | TEC | 142.15/5.55/4.30 | Process waste (004) to sluice outfall at manhole behind Building 245-M (composite) |
| E-8 | 15 | TEC | 142.15/5.80 | Incinerator ash scrubber water at outfall (008) to South Fork of the Holston River (composite) |
| E-8 | 16 | TEC | | Process waste to Kit Bottom at TEC sampler, outside Building 122 lift station (composite) |
| E-9 | 17 | TEC | 142.15/3.50 | Aerated lagoon effluent (002) to South Fork of the Holston River, at Long Island (composite) |
| E-9 | 18 | TEC | | Process waste to aerated lagoon, at Long Island lift station (composite) |
| E-9 | 19 | TEC | 142.15/4.50 | Long Island storm drainage overflow (003), at open ditch adjacent to Long Island lift station (composite) |
| E-8 | 20 | TEC | | Sanitary wastes pumped to the Kingsport Municipal Wastewater Treatment Plant at parshall flume behind Building 208 (composite) |
| E-8 | 21 | TEC | 142.15/4.80 | Raw water intake at Building 63 (composite) |
| E-8 | 22 | TEC | 142.15/5.20 | 13th Street sewer outfall (005), at Riverside Drive manhole (composite) |
| E-8 | 23 | TEC | 142.15/5.30 | 14th Street sewer outfall (006), at Riverside Drive manhole (composite) |

SAMPLE STATIONS (Cont.)

| Figure Number | Station Number | Industry | River Mileage | Location and Type of Samples |
|---|---|---|---|---|
| E-8 | 24 | TEC | 142.15/5.70 | Raw water intake at Building 269 (grab) |
| E-12 | 25 | HAAP "B" | 141.60 | Filter-plant backwash (001) at manhole adjacent to perimeter road (composite) |
| E-12 | 26 | HAAP "B" | 140.70 | Wastewater-treatment plant effluent (002), at clarifier overflow prior to chlorination (composite) |
| E-12 | 27 | HAAP "B" | 140.30 | Surface water drainage (003) from production lines 9 and 10, at open ditch adjacent to perimeter road (grab) |
| E-12 | 28 | HAAP "B" | 139.70 | Process wastes at sewer outfall (004), adjacent to perimeter road (composite) |
| E-12 | 29 | HAAP "B" | 139.60 | Process wastes and cooling water at outfall (005), adjacent to perimeter road (composite) |
| E-12 | 30 | HAAP "B" | 139.60 | Cooling and surface waters from production lines 6 and 7 at sewer outfall (005), adjacent to perimeter road (composite) |
| E-12 | 31 | HAAP "B" | 139.20 | Process wastes from production lines 3, 4, and 5 at sewer outfall (007), adjacent to perimter road (composite) |
| E-12 | 32 | HAAP "B" | 139.20 | Cooling water from production lines 3, 4, and 5 at sewer outfall (007), adjacent to perimeter road (composite) |
| E-12 | 33 | HAAP "B" | 137.90 | Main outfall ditch (008) at HAAP effluent water quality monitor station (composite) |

SAMPLE STATIONS (Cont.)

| Figure Number | Station Number | Industry | River Mileage | Location and Type of Samples |
|---|---|---|---|---|
| E-12 | 34 | HAAP "B" | 141.10 | Raw water intake at Building 201 pumphouse (composite) |
| E-12 | 35 | HAAP "B" | 137.9/0.3 | Arnott Branch, upstream of nitric acid production area (grab) |
| E-12 | 36 | HAAP "B" | 142.15/139.0 | Raw water intake at Building 209 pumphouse (composite) |
| E-2 | 37 | ASG Industries | 142.15/4.04 | ASG effluent (002) at ASG/HAAP "A" boundary fence |
| E-2 | 38 | ASG Industries | | Influent to clarifier at settling pit (composite) |
| | 39 | ASG Industries | 142.15/4.35 | ASG cooling water effluent (001) at manhole inside HAAP Area "A" (composite) |
| | 40 | J. P. Stevens | 142.15/4.31 | Outfall pipe 20 ft upstream of HAAP "A" (001) outfall (composite). Flow at manhole adjacent to ASG guard shack |
| E-5 | 41 | Mead Papers | 142.15/2.40 | Clarifier effluent before it mixes with the water plant by-pass discharge (composite) |
| E-5 | 42 | Mead Papers | 142.15/2.40 | Water-treatment plant backwash and overflow at parshall flume (composite) |
| E-5 | 43 | Mead Papers | 142.15/2.50 | Raw water intake at pumphouse on South Fork of the Holston River (composite) |
| E-3 | 44 | Holliston Mills | 129.04 | Raw water intake at water treatment unit (composite) |
| E-3 | 45 | Holliston Mills | 128.9/0.70 | Cooling-water discharge (002), at effluent weir (composite) |

SAMPLE STATIONS (Cont.)

| Figure Number | Station Number | Industry | River Mileage | Location and Type of Samples |
|---|---|---|---|---|
| E-3 | 46 | Holliston Mills | 129.2 | Discharge (001) to Holston River, at lagoon effluent weir (composite) |
| E-3 | 52 | Holliston Mills | | Wastewater-treatment-facility effluent to lagoon, at parshall flume (composite) |
| E-6 | 47 | Penn Dixie | 142.15/2.60 | Cooling-water effluent at discharge point to open ditch on Penn-Dixie property (composite) |
| E-6 | 48 | Penn Dixie | 142.15/2.60 | Process-waste and cooling-water effluent, at (001) discharge point to open ditch on Penn-Dixie property (composite) |
| E-6 | 49 | Penn Dixie | 142.15/2.62 | Raw water supply at South Fork of the Holston River intake structure (composite) |

STREAM SURVEY

| Figure Number | Station Number | Industry | River Mileage | Location and Type of Samples |
|---|---|---|---|---|
| IV-1 | 53 | | 142.15/0.20 | North Fork of the Holston River, at Netherland Inn Road Bridge |
| IV-1 | 54 | | 142.15/5.6 | South Fork of the Holston River, at Tennessee Hwy 99 Bridge (RM 5.6) |
| IV-1 | 55 | | 142.15/1.2 | South Fork of the Holston River, at Ridgefields Bridge (RM 1.2) |
| IV-1 | 56 | | 131.5 | Holston River, at Church Hill Bridge (RM 131.5) |

D-1

# APPENDIX D

# METHODS OF ANALYSIS AND SAMPLE PRESERVATION

## METHODS OF ANALYSIS AND SAMPLE PRESERVATION

Analyses for COD, sulfate, sulfide, phenolics, and BOD and DO were conducted according to standard methods (using the azide modification of the Winkler technique).*

All other laboratory analyses and field measurements were carried out in accordance with accepted standard techniques.**

Samples collected in the field were preserved as follows:

| Sample for Analysis of- | Preservative |
|---|---|
| Sulfate<br>Fluoride | None |
| BOD<br>Solids<br>Sulfide<br>Organics<br>Alkalinity | Ice*** |
| Sediment | Dry ice*** |
| Nutrients<br>COD<br>TOC | 1 ml conc. $H_2SO_4$/1 |
| Metals | 2 ml conc $HNO_3$/1 |
| Oil & Grease | 2 ml conc $H_2SO_4$/1 |
| Phenolics | 1 gm $CuSO_4$ + 1 ml conc $H_3PO_4$/1 |

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* M. J. Tarus, A. E. Greenberg, R. D. Hoak, and M. C. Rand, *Standard Methods for the Examination of Water and Wastewater*, 13th Edition, American Public Health Association. New York, New York. 1971.

** *Methods for Chemical Analysis of Water and Wastes*, Environmental Protection Agency, National Environmental Research Center, Analytical Quality Control Laboratory. Cincinnati, Ohio. July 1971.

*** Ice was packed around sample containers to lower temperature and retard bacteriological degradation.

E-1

# APPENDIX E

## WASTE SOURCE EVALUATIONS

# INTRODUCTION

This appendix summarizes information concerning industrial waste sources investigated in the Kingsport, Tennessee, vicinity.

Each industry was requested to grant permission to allow EPA personnel to sample waste sources and make flow measurements on company property. All industries were cooperative and granted permission to EPA personnel.

The format employed in preparation of the individual evaluation reports was not identical in all cases but generally resembled the following outline:

A. General -- includes background information and contacts;

B. Waste Sources and Treatment -- includes types of processes, sources of pollution, and waste treatment practices;

C. Plant Evaluations and Findings -- includes information on evaluation procedure, data from chemical analyses, field measurements, and observations.

D. Summary and Conclusions

E. Recommendations

## E-I. ASG INDUSTRIES, INCORPORATED
## KINGSPORT, TENNESSEE

### A. GENERAL

ASG Industries employs about 700 people and operates continuously. The company produces 198 tons/day of rolled glass, polished wire glass, and miscellaneous flat glass including tempered and laminated glass [Plant flow diagram Figure E-1]. Raw materials are sand (61 tons), soda ash (19 tons), limestone (15 tons), dolomite (6 tons), and various amounts of recycled glass. Other additives, such as saltcake, feldspar, aluminum hydrate, titanium oxide, carbon, sodium silicate fluoride, selenium and cobalt, are employed in order to obtain specific properties in the glass. Arsenic is used about two months out of the year; hydrofluoric acid is used for etching about one day/month.

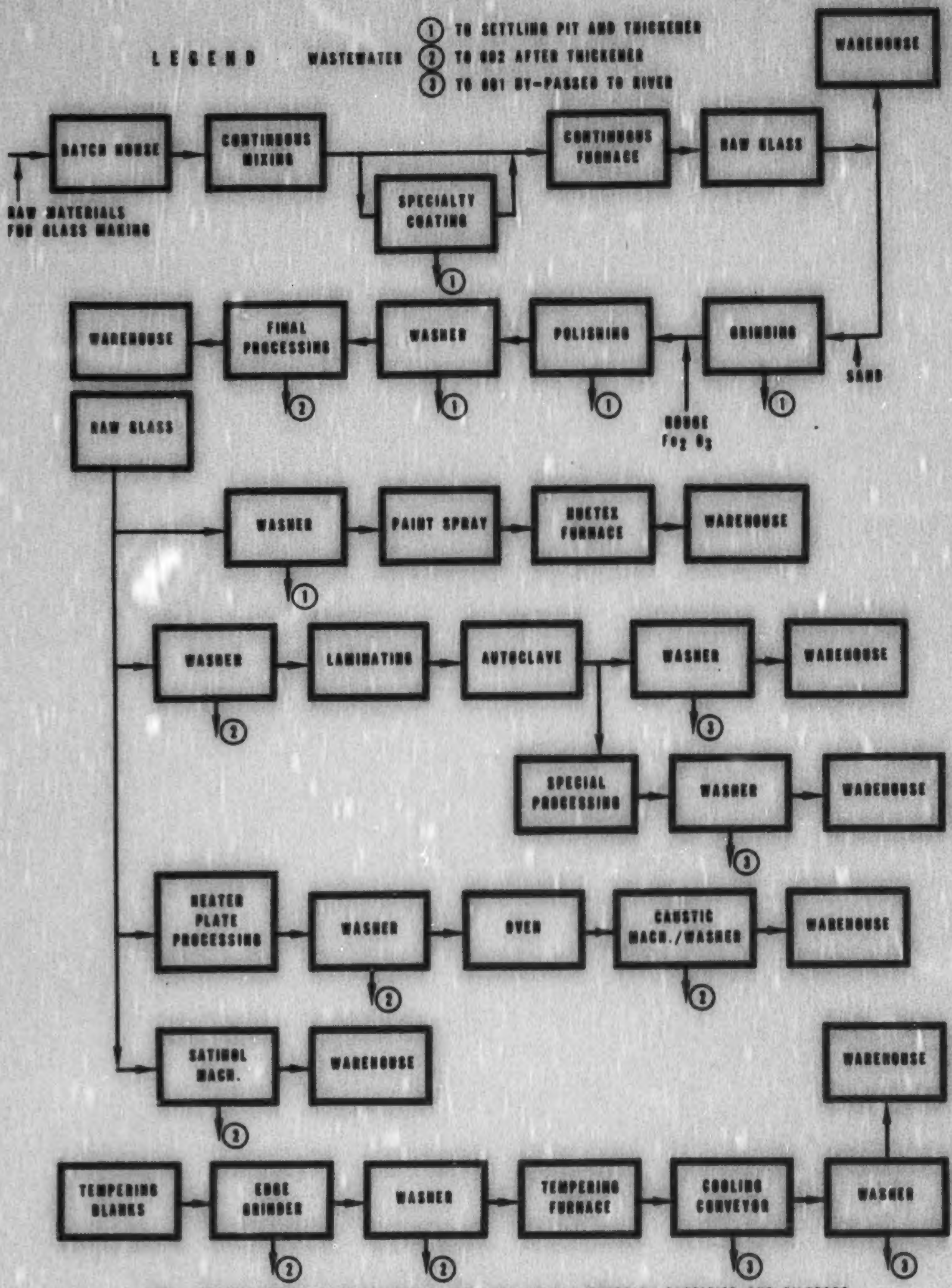
The raw materials are melted in four gas-fired furnaces. The glass passes out of the oven through large rollers and onto a conveyor belt which continuously moves through more water-cooled rollers. The glass is annealed and might be sent to the warehouse or be processed further. Generally, the glass is ground, using a sand and water slurry, then washed, and polished with rouge (ferric oxide). The glass can also be tempered or laminated, according to the demands for specific properties.

On 10 November 1972, EPA and Tennessee State personnel visited the plant. R. W. Smith, R. O. Bivens, and J. C. McDavid of ASG Industries provided information on plant processes.

### B. WASTE SOURCES AND TREATMENT

Water (approximately 0.94 mgd) is purchased from the Tennessee

E-2c


LEGEND
WASTEWATER
① TO SETTLING PIT AND THICKENER
② TO 002 AFTER THICKENER
③ TO 001 BY-PASSED TO RIVER
RAW MATERIALS FOR GLASS MAKING
BATCH HOUSE
CONTINUOUS MIXING
SPECIALTY COATING
CONTINUOUS FURNACE
RAW GLASS
WAREHOUSE
SAND
GRINDING
ROUGE $Fe_2O_3$
POLISHING
WASHER
FINAL PROCESSING
WAREHOUSE
RAW GLASS
WASHER
PAINT SPRAY
HUETEX FURNACE
WAREHOUSE
WASHER
LAMINATING
AUTOCLAVE
WASHER
WAREHOUSE
SPECIAL PROCESSING
WASHER
WAREHOUSE
HEATER PLATE PROCESSING
WASHER
OVEN
CAUSTIC MACH./WASHER
WAREHOUSE
SATINOL MACH.
WAREHOUSE
WAREHOUSE
TEMPERING BLANKS
EDGE GRINDER
WASHER
TEMPERING FURNACE
COOLING CONVEYOR
WASHER

NOTE: WATER SOURCE IS RIVER WATER THAT HAS BEEN CHEMICALLY CLARIFIED AND FILTERED

Figure E-1. Plant Flow Diagram—ASG Industries Kingsport, Tennessee

Eastman Company and is treated by alum coagulation, sedimentation, and filtration. One-half mgd is used for cooling water, 0.4 mgd for process water, and 0.04 mgd for boiler feed. City water (0.01 mgd) is employed for sanitary purposes.

The company has filed RAPP Applications for two discharges [Table E-1]. Outfall 001* (Station 39) contains surface run-off, cooling water and river water from a glass-washing operation. This wastewater is discharged directly to the South Fork of the Holston River without treatment.

The other discharge (002* - Station 37), consisting of wastewater from the grinding-and-polishing operation and specialty coating operation, and some rinse water from washers are treated. This wastewater enters a thickener tank [Figure E-2] through a central cylindrical section. The effluent is discharged via a peripheral weir. At 0.57 mgd, the surface overflow rate is 1,800 gpd/sq ft. About one pound of alum per 2,500 gal. of water (48 mg/l) is added in the center section, but no attempt is made to mix this alum with the wastewater. With no rapid mix or floc-culation of the clarifier feed, it is probable that the alum is not being used effectively for coagulation. Sludge removed from the clari-fier is vacuum filtered; the filtrate is returned to the thickener and the filter cake is hauled to a landfill for disposal.

The clarifier discharges into a ditch where the effluent joins a milky white rinse water from other washers. The combined flows discharge to the South Fork of the Holston River via an open ditch passing

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* This is the company designated discharge number in Refuse Act Permit Application. The discharge point is located on the property of the Holston Army Ammunition Plant.

## TABLE E-1

## EFFLUENT DISCHARGES FROM - ASG INDUSTRIES, INC.[a/]
## KINGSPORT, TENNESSEE

| Discharge Number | EPA Stn. No. | Flow mgd | Total Solids mg/1 | Volatile Solids mg/1 | Suspended Solids mg/1 | TOC mg/1 | BOD mg/1 | TKN mg/1 | $NO_3$-N mg/1 | Oil & Grease mg/1 | Phenolics mg/1 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 001 | 39 | 0.37 | 296 | 59 | 140 | 11.2 | 4 | 0.84 | 0.8 | 0.004 | |
| 002 | 37 | 0.57 | 2,170 | 90 | b/ | 11 | 2 | 0 | 1.6 | 0.02 | 22.5 |

---

a/ This data is from RAPP Application.

b/ The average suspended solids content of 002, in 1970, was 1,400 mg/1. Two 24-hr composite samples taken on 2 and 3 June 1971 averaged 1,948 mg/1 suspended solids.

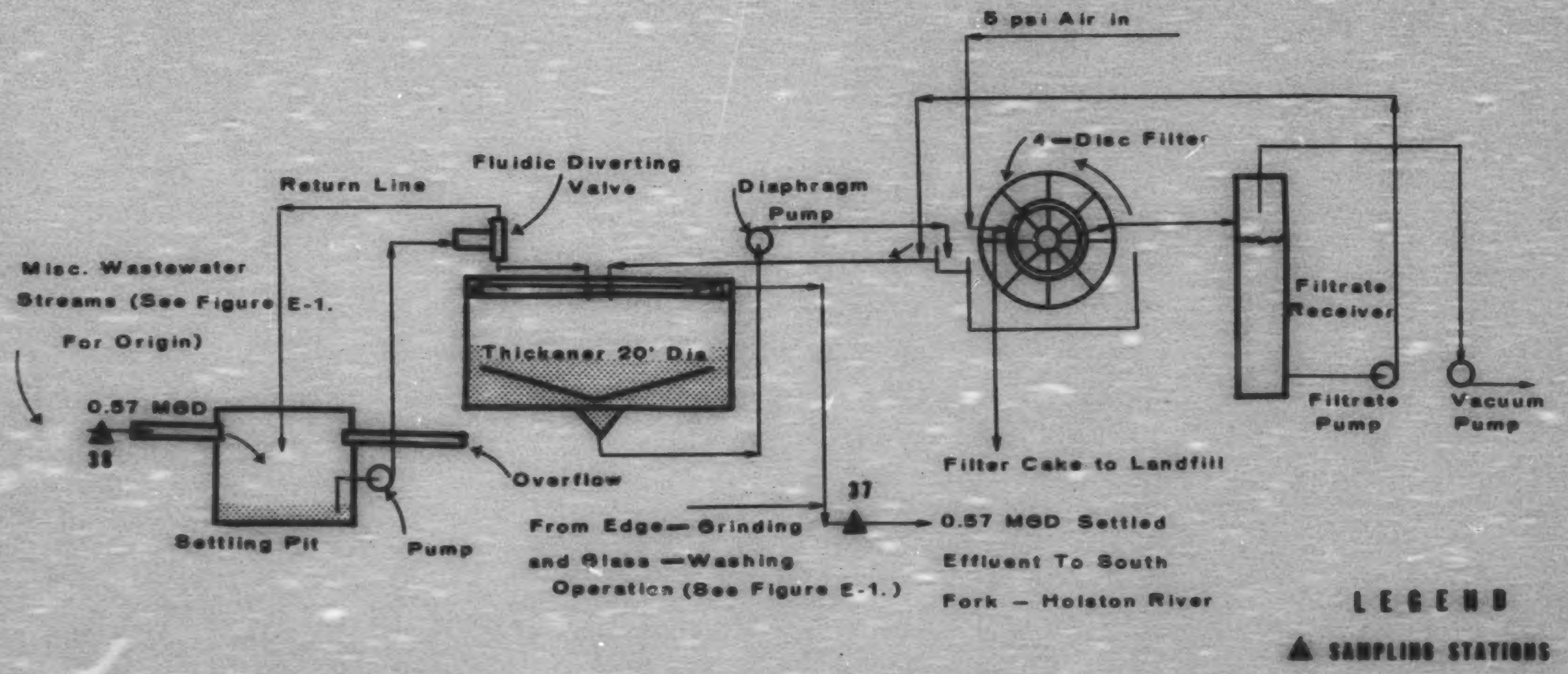
5 psi Air in
4—Disc Filter
Fluidic Diverting Valve
Return Line
Diaphragm Pump
Misc. Wastewater Streams (See Figure E-1. For Origin)
0.57 MGD
38
Thickener 20' Dia
Filtrate Receiver
Filtrate Pump
Vacuum Pump
Settling Pit
Pump
Overflow
Filter Cake to Landfill
37
From Edge—Grinding and Glass—Washing Operation (See Figure E-1.)
0.57 MGD Settled Effluent To South Fork – Holston River
LEGEND
▲ SAMPLING STATIONS

Figure E-2. Wastewater Treatment Flow Diagram – ASG Industries
Kingsport, Tennessee

through the property of the Holston Army Ammunition Plant (Station 37). At the time of the plant visit (10 November 1972) this stream had a deep red color. High concentrations of phenolic materials have been reported in this discharge [Table E-1]. Company officials indicated that the only source of phenolics was a floor-washing compound which they have discontinued using. Recent company data showed a phenolic content of 0.016 mg/l.

Samples of the clarifier influent and effluent and of the filtrate are collected daily, and data on pH, suspended and settleable solids are submitted to the State of Tennessee Stream Pollution Control Division. The average monthly suspended solids data submitted by ASG Industries to the State of Tennessee Stream Pollution Control Division are as follows.

### TABLE E-2

### ASG INDUSTRIES, INCORPORATED
### FINAL EFFLUENT-SUSPENDED SOLIDS
### KINGSPORT, TENNESSEE

| | Suspended Solids (mg/l)[a] | | |
|---|---|---|---|
| Month (1972) | Avg | Max | Min |
| May | 840 | 4,455 | Tr |
| June | 596 | 2,350 | 180 |
| July | 506 | 2,430 | 210 |
| August | 1,239 | 8,545 | 125 |
| September | 478 | 2,145 | 40 |
| October | 437 | 4,970 | 0 |

The wastewater from the glass-etching operation (hydrofluoric acid) is, according to company officials, percolated over a limestone bed before it joins other waste streams. However, this action is evidently not sufficient to neutralize the acid. On 9 and 10 June 1971, during the etching operation, process effluent samples collected by Tennessee Stream Pollution Control Division personnel indicated a pH of 3.2 and an acidity of 550 mg/l.

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[a] Water sampled is final effluent, or Station 37 on EPA 1972 survey.

The State, in 1968, recommended additional treatment for the process stream, just mentioned, or replacement of the present system with a lime or caustic neutralization system. Two years later, company officials notified the State that the additional investment for neutralization equipment was not justified because the demand for acid-treated glass is decreasing and that acid treatment would probably not be necessary after 1975. At the time of the survey neutralization on limestone was still being used.

Storm water is discharged through a sewer line owned by the J. P. Stevens Company to which ASG has an easement. Sanitary wastes are sent to the Kingsport municipal Wastewater Treatment Plant.

## C. DISCUSSION OF STUDY FINDINGS

This industry was sampled at three locations for three consecutive days from 30 November to 3 December 1972. The three sampling points were: the clarifier influent (Station 38); the effluent (after it joined a washwater stream) at the point where it entered the property of the Holston Army Ammunition Plant (Station 37); and the cooling-water discharge in a manhole on HAAP property (Station 39). Using SERCO automatic samplers, EPA personnel collected samples and composited them on an equal-volume basis at the end of each 24-hr period.

The cooling-water discharge (1.2 mgd) contained 460 lb/day suspended solids and had an oil-and-grease concentration ranging from 4-7 mg/l. Samples of the clarifier influent (Station 38) taken during the survey [Table E-3] had an average, suspended-solids concentration of 15,700 mg/l while the level in the effluent waste stream was 843 mg/l or 3,600 lb/day. The influent contained 185 mg/l of iron, and the effluent averaged 6.1 mg/l (26 lb/day). The pH on this discharge ranged from 6.5-10.9; the COD load averaged 179 lb/day.

Jar tests were performed on the influent wastewater to the clarifier in order to determine solids-removal efficiency. The test involved the use of two anionic polymers, a cationic polymer, and ferric sulfate and alum as coagulants. The suspended-solids concentration of the influent sample was 9,200 mg/l. The most effective coagulant for improving suspended-solids removal was ferric sulfate at a dosage rate of 100 mg/l. As a result, the suspended solids in the supernatant was reduced to 21 mg/l. Reducing the pH to 7.0, before the addition of ferric sulfate, further improved the suspended-solids removal efficiency (14 mg/l in the supernantant). Alum was less effective than ferric sulfate. The optimum dosage was 100 mg/l, leaving 58 mg/l suspended solids in the supernatant and resulting in floc that was small and settled slowly.

A dosage of 0.5 mg/l anionic polymer (A 23, Dow Chemical Co.) used with either 100 mg/l ferric sulfate or alum doubled the settling rate and improved the removal of suspended solids even further. After only five minutes, the concentrations of suspended solids were 33 mg/l with ferric sulfate and 40 mg/l with alum. With employment of these chemicals,

### TABLE E-3

### SUMMARY OF FIELD MEASUREMENTS AND CHEMICAL DATA
ASG INDUSTRIES, INC.
KINGSPORT, TENNESSEE
1-3 DECEMBER 1972

| Station Number | 37 | | 38 | | 39 | |
|---|---|---|---|---|---|---|
| Station Description[a/] | Effluent (RM 142.15/4.01) | | Influent to Clarifier | | Cooling Water (RM 142.[illegible]/4.01) | |
| Parameter[b/] | Range | Average | Range | Average | Range | Average |
| Flow (mgd) | 0.47-0.55 | 0.52 | | 0.50 | 0.94-1.47 | 1.21 |
| pH (standard units) | 6.5-10.9 | | 7.3-8.4 | | 7.4-8.5 | |
| Temperature (°C) | 15.0-20.0 | | 17.0-21.0 | | 22.0-25.0 | |
| Conductivity (μmhos/cm) | 250-725 | | 250-300 | | 240-260 | |
| COD | 40-42 | 41 | | | | |
| TOC | 10[c/] | | | | | |
| Total Solids | 879-1,370 | 1,123 | | | 228-434 | 312 |
| Suspended Solids | 599-1,050 | 843 | 13,200-17,000 | 15,700 | 25-66 | 47 |
| Suspended Solids (lb/day) | | 3,600 | | 66,000 | | 460 |
| Oil and Grease | | | | | 4-7 | 6 |
| Phenols | N.D.[d/] | | | | <0.01-0.08 | 0.03 |
| Copper | 0.02-0.10 | 0.05 | | | | |
| Chromium | <0.01-0.03 | 0.02 | | | N.D. | |
| Iron | 1.12-10.0 | 6.1 | 170-200 | 185 | | |
| Manganese | 0.24-0.30 | 0.27 | | | | |
| Antimony | N.D. | | | | | |
| Cobalt | N.D. | | | | | |
| Floride | 0.76-0.94 | 0.83 | | | | |

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a/ See Appendix C for Station Description.
b/ All values reported as mg/l, except where otherwise specified.
c/ This is based on one value.
d/ N.D. - None Detected.

it is highly desirable to rapid-mix immediately following chemical addition and slow-mix for formation of a settleable floc. Dumping coagulants into the clarifier, as presently practiced at ASG, precludes adequate mixing and prevents efficient coagulation.

According to the EPA interim Effluent Guidelines for the Cement, Lime, Gypsum, and Asbestos and Flat-Glass Industries (dated 21 September 1972), a typical process and cooling-water stream for a plant of this type would be about 0.1 mgd. Effluent limitations for the total plant discharge are as follows:

| Parameter | lb/1,000 tons glass produced | lb/day (This Size Plant) | Actual Load (lb/day) Discharged During Survey |
|---|---|---|---|
| Suspended Solids | 84 | 16.6 | 4,060 |
| COD | 84 | 16.6 | 179 |

The guidelines also recommend that no more than 4.2 lb each of hexane extractables and total phosphorus be discharged, per 1,000 tons of glass.

The average suspended-solids load discharged during the survey was more than 200 times the recommended limit; the COD was about 10 times the proposed load. Oil and grease was detected in the cooling-water stream in a quantity greater than the guideline limitations. This material should not be present in an uncontaminated cooling-water discharge.

The suspended solids in the cooling-water stream alone exceeded the guideline limitations. The company should first segregate the washer rinse water from the cooling-water stream, then recirculate the cooling water (after treatment, if it proves necessary).

The loads and flow rates proposed in these guidelines are based on the best practicable control technology currently available. They employ maximum practical recirculation and re-use of cooling waters, sedimentation, neutralization, and other control methods derived from demonstration projects, pilot plants, and actual industrial use.

The guidelines propose that a 24-hr composite sample be collected for COD, suspended solids, total phosphorus and hexane extractables (oil and grease) every two weeks and that the flow be monitored continuously. It shall be considered a violation of the waste discharge permit if the average analyses over any 20 working days exceeds the limitations or if any single composite sample exceeds these limits by more than 50 percent. Four violations in any one single year will require an action memorandum from the Regional Administrator containing recommendations on what action is to be taken. Any single violation of the permit is grounds for its revocation. Implementation of this monitoring program is considered necessary to ensure adequate pollution control and should be a requirement of the permit issued to this industry.

## D. SUMMARY AND CONCLUSIONS

1. Jar tests performed on the influent wastewater to the ASG clarifier revealed that suspended-solids removal could be improved by the addition of an anionic polymer and ferric sulfate and by maintaining the pH at 7.0. The present method of adding alum into the clarifier feed without proper mixing is not conducive to effective coagulation.

2. ASG Industries, Inc., discharged untreated wastewater and cooling water (1.2 mgd) and treated wastewater (0.52 mgd) to the South Fork of

the Holston River. The average daily loads from these two discharges contained 4,060 lb of suspended solids and 179 lb of COD. The oil and grease in the cooling-water stream ranged from 4 to 7 mg/l indicating contamination. These loads are greatly in excess of those recommended in the EPA interim Effluent Guidelines which, for a plant of this kind, limit the loads to 16.6 lb/day each of suspended solids and COD.

3. Additional treatment is necessary at ASG to meet the effluent guidelines for suspended solids and COD. All wastewaters need to be segregated from uncontaminated cooling waters and conservation and water re-use must be practiced if the limits are to be met. Improved coagulation methods will also aid in meeting the guidelines.

4. In the past (1968) ASG Industries has been advised by the State to neutralize their process waste stream with lime or caustic when the glass-etching process is in operation. The company advised the State in 1970 that the additional investment involved was not justified. No further action has been taken.

## E. RECOMMENDATIONS

It is recommended that:

1. To meet the EPA interim Effluent Guidelines, based on the best practicable control technology currently available, the total wasteload discharged shall not exceed the following limits:

| Parameter | lb/day |
|---|---|
| Suspended Solids | 16.6 |
| COD | 16.6 |
| Hexane Extractables (oil & grease) | 2.1 |
| Total Phosphorus | 2.1 |

2. All additional effluent requirements established by the State of Tennessee shall be met.

3. A schedule and proposed method of treatment for achieving the necessary pollution abatement be provided EPA, Region IV, by 15 October 1973.

## E-II. HOLLISTON MILLS, INCORPORATED
## KINGSPORT, TENNESSEE

### A. GENERAL

This mill, located about 12 miles west of Kingsport, is included under the broad classification of textile manufacturing (SIC 22).

The major products of this plant are divided into two general classes: starch (cornstarch)-filled book cloth (about 20 percent) and plastic-covered bookcloth (approx. 80 percent), which can include plastic on cloth; plastic on paper; and a combination of cloth and paper. In addition to bookcloth other finished products are shade cloth and various auto materials.

The finished product is manufactured at a rate of 250,000 yd/day. The average weight of the starch cloth is about seven oz/yd whereas plastic-coated products will average approximately eight oz/yd of which an estimated 20 to 25 percent is plastic. The Holliston Mills plant at Kingsport employs 550 people and operates 16 hr/day five days a week.

The normal process operations consist of subjecting cotton greige goods to:

1. Starch Department Operations
    - a) Enzyme desizing with the cloth being held approximately 24 hr prior to enzyme removal
    - b) Washing with some washwater return back to desizing
    - c) Caustic scouring (four percent caustic solution for removal of gums, oils, waxes, and final enzyme destruction)
    - d) Two-stage washing (supposedly with washwater return to caustic scour)
    - e) Hypochlorite bleaching

f) Neutralization of the hypochlorite solution by means of bisulfite or equivalent.

g) Washing

h) Interim cloth storage

i) Water saturation of the cloth in continuously overflowing vats

j) Application of aqueous dyes and/or pigments to the cloth (dyeing may also be combined with the sizing operations, Step 11)

k) Sizing

2. Plastic Department Operations

   a) Goods transferred from the starch department undergo the addition of various plasticizers onto the polyvinyl-acetate-starch filled cloth and papers

   b) Auxiliary operations include pigment addition, differential setting followed by further pigment addition giving an over-printing or embossing effect

A RAPP* application was filed with the U.S. Army Corps of Engineers on 25 June 1971. It lists one cooling-water outfall and one process outfall.

EPA and State of Tennessee personnel made a plant inspection on 10 November 1972. Ken Young, chief chemist, provided information and assistance. An in-plant survey was conducted from 6 through 8 December 1972.

## B. WASTE SOURCES AND TREATMENT

Water (approx. 1 mgd) is pumped from the Holston River and treated with alum and a polymer (for coagulation/clarification), followed by sand filtration. Of this volume of water, 0.83 mgd is used for cooling water, 0.12 mgd for boiler feed, and 0.05 for process water. An additional 0.01 mgd is purchased from a privately owned company in Church Hill, Tennessee, and is employed for sanitary purposes.

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* The Federal Water Pollution Control Act Amendments of 1972 stipulate that the Refuse Act Permit application be processed through the National Pollution Discharge Elimination System (NPDES).

Holliston Mills, Inc., has two discharges (Stations 45 and 46). All liquid wastes originate from the starch department operations. (The company reported that the plastic department plant has been sealed off from the sewer.) The starch plant wastes, together with plant sanitary sewage and some cooling waters, are collected and passed through biological treatment works [Figure E-3] before being discharged (Station 46). The waste-treatment processes consist of pH control, screening, primary and secondary clarification, trickling filtration, and lagooning. The WWTP was not fully operational until September 1972.

The wastewater enters the treatment works through a concrete channel equipped with pH control and flow measurement. The flow is lifted by a screw conveyor and falls vertically through a bar screen before entering the primary clarifier where a pH of 6 to 8 is maintained. At the time of the initial EPA visit, globules of starch were evident on the water surface of the clarifier. Sludge from the primary clarifier proceeds to the No. 1 half-acre lagoon and then to a two-acre lagoon. Overflow from the latter passes directly to the river.

The primary effluent is cascaded down a large polyvinyl-chloride-packed tower serving as a biological trickling filter. A portion of the trickling-filter effluent is recirculated to the filter inlet: the remainder goes to a secondary clarifier. Secondary sludge is returned to the primary clarifier. Overflow from the secondary clarifier flows to the No. 2 half-acre lagoon that also discharges to the two-acre lagoon.

These lagoons (Nos. 1 and 2 and the two-acre lagoon) were intended to serve as polishing ponds. However, the company reports that the ponds are so badly loaded with solids that the waste concentration actually increases between the points of pond inflow and outflow. The company reported that the influent BOD to its WWTP averages 600 mg/1; 250 mg/1 leaves the secondary clarifier and the final effluent averages 400 mg/1.

Since 1968 the Holliston waste-treatment system has been the subject of a research and development study partially funded by an EPA grant. The system was completed in July 1972, but not considered fully operational until September 1972. The last phase of the R & D project will be directed to an evaluation of the overall treatment system. In addition, the company is considering the installation of an enzyme digester to convert primary sludge starches into sugars that would then be recycled back to the primary clarifier. After three months of operation, only minimum biological growth was observed on the trickling filter.

Water-treatment clarifier sludges and backwashes are discharged to a drain that empties into Sevier Branch, a tributary of the Holston River (Station 45). This discharge (about 0.3 mgd) contains boiler blowdown and some floor washdown.

The company monitors the raw wastes and the lagoon influent on a daily basis. Sludges leaving the primary clarifier and the lagoon effluent are monitored on a weekly basis. Test parameters include flow, BOD, SS, pH, color, and alkalinity.

E-16a

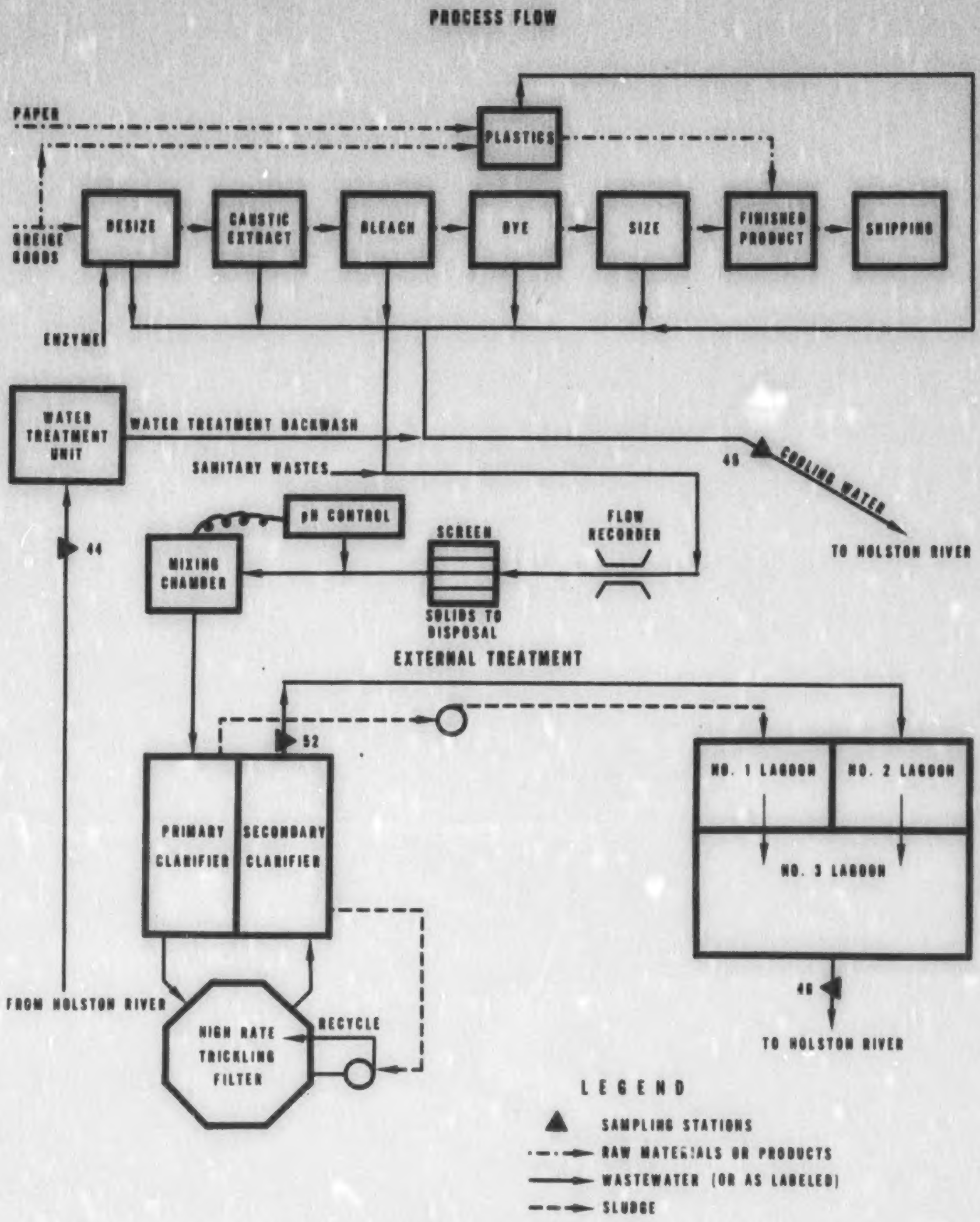
PROCESS FLOW
PAPER
PLASTICS
GREIGE GOODS
DESIZE
CAUSTIC EXTRACT
BLEACH
DYE
SIZE
FINISHED PRODUCT
SHIPPING
ENZYME
WATER TREATMENT UNIT
WATER TREATMENT BACKWASH
SANITARY WASTES
45
COOLING WATER
TO HOLSTON RIVER
pH CONTROL
MIXING CHAMBER
SCREEN
SOLIDS TO DISPOSAL
FLOW RECORDER
44
EXTERNAL TREATMENT
52
PRIMARY CLARIFIER
SECONDARY CLARIFIER
NO. 1 LAGOON
NO. 2 LAGOON
NO. 3 LAGOON
46
TO HOLSTON RIVER
FROM HOLSTON RIVER
HIGH RATE TRICKLING FILTER
RECYCLE
LEGEND
SAMPLING STATIONS
RAW MATERIALS OR PRODUCTS
WASTEWATER (OR AS LABELED)
SLUDGE

Figure E-3. Wastewater Treatment System Flow Diagram-Holliston Mills, Incorporated Kingsport, Tennessee

At the time of the initial EPA visit, poor housekeeping practices were observed. A major portion of the spent color pastes, which are supposed to be collected in barrels, were entering the floor drains. Holliston Mills has some degree of water re-use in the desize-wash-scour department; generally, desize solutions and washes are wasted to floor drains as are spent thin-starch solutions. Cooling waters are used on a once-through basis and then discharged into the river. Cleaning rags, residues particularly from cleanup in the plastics plant, are picked up and taken to the company landfill (non-combustibles) or the incinerator. The incinerator consists of two chambers. Exhaust smoke from the first chamber is further combusted in the second compartment. The latter is reported highly efficient, according to company officials. There is no scrubbing of the incinerator stack emissions, and the bottom ash resulting from the combustion process is removed to the company landfill area.

## C. PLANT EVALUATION AND FINDINGS

For three consecutive days EPA personnel sampled the cooling-water discharge (Station 45), lagoon influent (Station 52), and the lagoon effluent (Station 46). Hourly samples were collected by SERCO automatic samplers and composited on an equalvolume basis after a 24-hr period. Three grab samples, for analysis of oil and grease and of phenolics, were manually collected over a four-to-six-hr period and composited on an equal-volume basis. A single grab sample was taken for sulfide analysis.

The river water intake (Station 44) was also sampled for three days with a SERCO automatic sampler and composited on an equal-volume basis after each 24-hr period. Temperature, pH, and conductivity measurements were made at least three times per rday. [Appendix C: station descriptions and locations.]

Flows at Stations 45 and 46 were obtained from flow recorders installed at company weirs. Station 52 was equipped with a Parshall flume and a continuous-flow recorder.

The cooling-water waste stream (Station 45) contained suspended solids and BOD loads of 94 lb/day and 30 lb/day, respectively [Table E-4]. The flow averaged about 0.28 mgd, considerably less than the 0.83 mgd reported by the Company personnel. While the concentration of BOD remained essentially the same as the raw intake water [13 mg/l vs 11 mg/l) the average concentrations of suspended solids increased from 19 mg/l to 40 mg/l, total Kjeldahl-nitrogen increased from less than 0.7 mg/l to 1.4 mg/l, total phosphorus increased from 0.2 mg/l to 1.2 mg/l, and sulfate increased from 27 mg/l to 66 mg/l, thus indicating that the cooling-water was being contaminated by process wastes. At the time of the initial plant visit, yellow and orange pigments (containing lead chromate) were being used in the plastic plant. According to company officials, with only a few exceptions, use of lead chromate pigments was to be discontinued in December 1972. During the survey the concentration of chromium in this stream ranged from 0.13 to 0.16 mg/l, thus indicating a possible reduction in the use of these pigments. Phenolic concentrations ranging from 0.01 to 0.03 mg/l were found during the survey, indicating that the plastics-coating area was probably completely enclosed at the time.

## TABLE E-4

## SUMMARY OF FIELD MEASUREMENTS AND CHEMICAL DATA
HOLLISTON MILLS INCORPORATED
KINGSPORT, TENNESSEE
6-8 DECEMBER 1972

| Station Number | 44 | | 45 | | 46 | | 32 | |
|---|---|---|---|---|---|---|---|---|
| Station Description[a/] | Water Intake (RM 130.0) | | Cooling Water (RM 128.9/0.7) | | Lagoon Effluent (RM 128.9/0.4) | | Lagoon Influent | |
| Parameter[b/] | Range | Average | Range | Average | Range | Average | Range | Average |
| Flow (mgd) | 0.960[c/] | | 0.272-0.286 | 0.279 | 0.394-0.427 | 0.412 | 0.681-0.733 | 0.707 |
| pH (standard units) | 6.9-8.0 | | 7.5-9.9 | | 6.3-6.5 | | 6.0-6.8 | |
| Temperature (°C) | 10.0-13.0 | | 14.0-18.5 | | 10.0-14.0 | | 13.0-19.5 | |
| Conductivity (µmhos/cm) | 280-380 | | 250-8,000 | | 950-1,500 | | 750-1,500 | |
| BOD | 6.3-20 | 11 | 6.2-21 | 13 | 270-470 | 380 | 290-430 | 372 |
| BOD (lb/day) | | 87 | | 30 | | 1,940 | | 2,180 |
| COD | | | 45-59 | 52 | 693-714 | 701 | 502-783 | 618 |
| TOC | 3.0-8.0 | 6.3 | 9-14 | 12 | 190-240 | 215 | 133-300 | 209 |
| Total Solids | 194-236 | 217 | 354-1,190 | 687 | 1,230-1,390 | 1,260 | 1,220-1,380 | 1,300 |
| Suspended Solids | 7-28 | 19 | 19-77 | 40 | 12-49 | 39 | 86-304 | 168 |
| Suspended Solids (lb/day) | | 150 | | 94 | | 205 | | 978 |
| Total Kjeldahl Nitrogen-N | <0.5-1.4 | <0.7 | 0.7-2.4 | 1.4 | 7.0-8.0 | 7.5 | 7.0-11.0 | 8.7 |
| Total Kjeldahl Nitrogen-N (lb/day) | | | | | | 39.0 | | 51.3 |
| $NH_3$-N | <0.3-1.6 | <0.3 | 0.5-1.2 | 0.7 | 1.6-3.8 | 2.7 | 1.3-4.0 | 2.3 |
| $NH_3$-N (lb/day) | | | | | | 14.0 | | 13.4 |
| $NO_2$ + $NO_3$-N | 0.8-0.9 | 0.8 | 1.1-1.2 | 1.2 | 0.1-0.7 | 0.4 | 0.1[d/] | 0.1 |
| Total Phosphorus-P | 0.1-0.3 | 0.2 | 0.87-1.7 | 1.2 | 4.6-5.3 | 4.9 | 3.5-3.7 | 3.6 |
| Total Phosphorus-P (lb/day) | | | | | | 25.6 | | 21.2 |
| Oil and Grease | | | | | 3-10 | 7 | 3-14 | 9 |
| Phenols | | | | | 0.01-0.03 | 0.02 | 0.02[d/] | 0.02 |
| Sulfide | | | | | 40-50 | 43 | 40-60 | 53 |
| Sulfate | 26-27 | 26.5 | 65-68 | 66 | 114-131 | 120 | 221-289 | 255 |
| Mercury, µg/l | | | | | 0.2-0.4 | 0.3 | <0.1-0.1 | <0.1 |
| Chromium | | | | | 0.13-0.16 | 0.14 | 0.11-0.18 | 0.14 |
| Cadmium | | | | | N.D.[e/] | | N.D. | |
| Nickel | | | | | | | <0.1[f/] | |
| Zinc | | | | | 0.08-0.09 | 0.08 | 0.07-0.35 | 0.16 |
| Lead | | | | | 0.3-0.4 | 0.3 | 0.5[d/] | 0.5 |
| Tin | | | | | N.D. | | N.D. | |

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a/ See Appendix C for Station Description.
b/ All values reported as mg/l, except where otherwise specified.
c/ Flow determined from in-plant data.
d/ All values are the same.
e/ N.D. - None Detected.
f/ This is based on one value.

Although the suspended-solids and sulfate loads of the lagoon influent were reduced by approximately 20 and 41 percent, respectively, other pollutant concentrations increased [Table E-4].* Moreover, the influent flow averaged 0.7 mgd, but the effluent averaged 0.6 mgd. The difference in flows indicates excessive seepage from the lagoons.

The EPA interim Effluent Guidelines (22 September 1972) limit the discharge from this type of mill to no more than six lb each of BOD and suspended solids and 0.06 lb of sulfides per 1,000 lb of product per day [Table E-5].

### TABLE E-5

### EPA INTERIM EFFLUENT LIMITATIONS

| | lb/1,000 lb prod. | lb/day this type plant | lb/day at Holliston |
|---|---|---|---|
| BOD | 6 | 700 | 1,970 |
| SS | 6 | 700 | 294 |
| Chromium | 0.03 | 3.5 | 0.73 |
| Phenolics | 0.03 | 3.5 | 0.1 |
| Sulfides | 0.06 | 7.0 | 221 |

Based on a production of 250,000 yd per day with an average weight of 7.5 oz/yd, the Holliston Mills discharge would be limited to a maximum of 700 lb/day each of BOD and suspended solids and 7 lb/day of sulfide. Currently the plant discharges a combined daily BOD load of 1,970 lb and 221 lb of sulfides. The BOD discharged was approximately one half of that reported in the RAPP application [Table E-6].

The 1969 FWQA survey concluded that, in order to maintain a minimum

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* Company personnel had indicated, in the 10 November meeting, that concentrations of pollutants increased in passing through the lagoons.

## TABLE E-6

## WASTEWATER DISCHARGED FROM HOLLISTON MILLS
## DATA FROM RAPP APPLICATION
## 25 JUNE 1971

| Station No. | 46 | | 45 | |
|---|---|---|---|---|
| RAPP Discharge No. | (001) | | (002) | |
| Parameter | mg/l | lb/day | mg/l | lb/day |
| Daily Avg. Flow (mgd) | 0.715 | | 0.292 | |
| BOD | 657 | 3,920 | 7.0 | 18.0 |
| COD | 1,896 | 11,320 | 14.0 | 35.0 |
| Total Solids | 2,560 | 15,300 | 506 | 1,230 |
| Suspended Solids | 144 | 860 | 55 | 134 |
| Total Kjeldahl Nitrogen | 15.8 | 94 | 15.4 | 37.6 |
| Total Org-N | 15.7 | 93.7 | | |
| $NO_3$-N | 0.49 | 2.92 | 1.5 | 3.66 |
| $NH_3$-N | 1.07 | 6.38 | 13.4 | 32.8 |
| Total Phosphorus | 1.2 | 7.4 | 1.33 | 3.24 |
| Alkalinity | 779 | 4,650 | 85 | 207 |
| Sulfate | 148 | 883 | | |
| Phenolics* | 56 | 334 | | |
| Chromium* | <200 | | | |

concentration of 3.0 mg/l DO in the Holston River, the maximum BOD load discharged from the Company should be limited to a maximum of 260 lb/day. However, to maintain a minimum of 5.0 mg/l DO, the official standard, in the river, the maximum BOD discharge should not be greater than 150 lb/day. The current wastewater-treatment facility is not providing adequate treatment to protect the water quality. Additional treatment measures, employing, as a minimum, best practicable control technology, are necessary to reduce the pollutant loads. Monitoring of all discharges and river water must be done on a continual basis to ensure that good river water quality conditions are maintained.

## D. SUMMARY AND CONCLUSIONS

1. Holliston Mills discharges cooling water containing a BOD and suspended-solids load of 30 lb/day and 94 lb/day, respectively. The average flow, 0.28 mgd, was considerably less than the 0.83 mgd reported by the Company. While the concentration of BOD remained essentially the same as the raw intake water, increases in the concentrations from background levels of suspended solids (19 mg/l to 40 mg/l), total Kjeldah nitrogen (0.7 mg/l to 1.4 mg/l), total phosphorus (0.2 mg/l to 1.2 mg/l), and sulfate (27 mg/l to 66 mg/l) indicated that the cooling-water was being contaminated by process wastewater.

2. Process wastewater is treated prior to discharge. The influent flow to the wastewater lagoon averaged 0.7 mgd and the effluent flow averaged 0.6 mgd, thus demonstrating that excessive exfiltration from the lagoon bottom was occurring. The suspended solids and sulfates in

the polishing lagoon influent were reduced by 20 and 41 percent, respectively. However, all other concentrations of pollutants increased or remained essentially the same before discharge. The treatment system was not performing efficiently.

3. The effluent from the lagoon contained a total load of 1,940 lb BOD/day, 200 lb suspended solids/day, and 221 lb sulfide/day. The EPA interim Effluent Guidelines limit the discharges of BOD and suspended solids to 700 lb/day each and sulfide to 7 lb/day. However, the 1969 FWQA study concluded that, in order to maintain a minimum DO concentration of 3.0 mg/l in the Holston River, the maximum BOD discharge from Holliston Mills should not exceed 260 lb/day. To maintain a minimum DO concentration of 5.0 mg/l, the maximum BOD discharged should not be greater than 150 lb/day.

## E. RECOMMENDATIONS

It is recommended that:

1. To maintain a minimum concentration of 5.0 mg/l DO in the Holston River, the BOD in the effluent shall not exceed 150 lb/day. The suspended solids shall not exceed 150 lb/day above background levels. Chromium and phenolics, each shall not exceed 3.5 lb/day, and sulfide shall not exceed 7.0 lb/day.

2. All additional effluent requirements established by the State of Tennessee shall be met.

3. The cooling-water and process-wastewater streams shall be segregated.

4. Holliston Mills, Inc., in its manufacturing processes, shall incorporate more in-plant control measures, re-use of cooling water, and improved housekeeping in order to prevent solvents, sizing agents, dyes, pigments, plastics, and other contaminants from entering the wastewater system.

5. A schedule and proposed method of treatment for achieving the necessary pollution abatement be provided EPA, Region IV, by 15 October 1973.

## E-III. J. P. STEVENS AND COMPANY, INC.
## KINGSPORT, TENNESSEE

### A. GENERAL

The J. P. Stevens Borden Plant was built in 1924. This facility converts approximately 54,000 lb/day of baled cotton into greige cotton (untreated condition, just as it comes from the loom) fabric by carding, spinning, and weaving. After spinning and prior to weaving, approximately 50 percent of the yarn (warp) is sized with a 14-percent cornstarch solution. The plant operates 24 hr/day, six days a week, and employs 700 people.

A RAPP* application has not been filed because all wastewater flows into the municipal sewer system.

EPA personnel conducted an interview of plant personnel on 9 November 1972. J. Marshall Beck, plant manager, provided information and assistance. The plant wastewater was sampled 1-2 December 1972.

### B. WASTE SOURCES AND TREATMENT

The company purchases all of its water, 43,000 gpd, from the City of Kingsport. Most of the water is used as once-through, non-contact cooling water and for spray humidity control. Process water is recycled and re-used. A cooling tower for the chilled air conditioning system is used during the summer season (5-6 months/year).

All wastes, including storm drainage, cooling tower blow down, and approximately 50 gal. of process rinse water (10-15 percent cornstarch, dumped once per week) is discharged to the Kingsport WWTP.

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* The Federal Water Pollution Control Act Amendments of 1972 provide that the Refuse Act permit applications be processed through the National Pollutant Discharge Elimination System (NPDES).

## C. PLANT EVALUATION AND FINDINGS

On 1 December 1972, Rhodamine WT 20 Dye was mixed with the company effluent at the last manhole on the premises before entering the municipal sewer. Forty-five minutes later the dye was observed in the discharge from a 36-in. outfall to the South Fork of the Holston River (Station 40 - RM 142.15/4.3). This outfall line carries excess storm water that originates on company property. Mr. Beck was informed of the discharge, and he contacted City of Kingsport officials. Trash and debris had blocked the interceptor line and diverted the flow to the river. This material was removed by City personnel on 6 December 1972, 6 days after by-passing was determined.

Samples of the wastewater at Station 40 were collected manually every two hr for 14 hr, beginning at 1600 hr on 1 December, and for 24 hr, beginning at 0800 hr on 2 December 1972. These samples were composited continually on an equal-volume basis during each sampling period. Temperature, pH, and conductivity were measured each time samples were collected. Instantaneous flows were measured every two hr with a Marsh-McBirney electromagnetic current meter. [Chemical data and field measurements are summarized in Table E-7.]

The average flow was 1.3 mgd. However, the discharge included domestic waste flows from residential areas. The BOD and suspended-solids levels were 58 and 43 mg/1, respectively. The characteristics of the waste indicate that the discharge was domestic in nature.

## TABLE E-7

## SUMMARY OF FIELD MEASUREMENTS AND CHEMICAL DATA
## J. P. STEVENS AND COMPANY, INC.
## KINGSPORT, TENNESSEE
## 1-2 DECEMBER 1972

| Station Number and Description[a] | 40 - Outfall Pipe (RM 142.15/4.30) | | |
|---|---|---|---|
| Date Sampled | 1 December | 2 December | Average |
| Parameter[b] | | | |
| Flow (mgd)[c] | 1.30 | 1.26 | 1.28 |
| pH (standard units), range | 6.5-7.0 | 6.2-7.3 | 6.2-7.3 |
| Temperature (°C), range | 20.0-21.0 | 18.0-23.0 | 18.0-23.0 |
| Conductivity (μmhos/cm), range | 340-440 | 320-580 | 320-580 |
| BOD | 48 | 76 | 58 |
| COD | 72 | 127 | 100 |
| TOC | 18 | 29 | 24 |
| Total Solids | 306 | 339 | 322 |
| Suspended Solids | 37 | 48 | 43 |
| Total Kjeldahl Nitrogen-N | 9.8 | 7.6 | 8.7 |
| $NH_3$-N | 3.4 | 3.3 | 3.4 |
| $NO_2$ + $NO_3$-N | 0.3 | 0.4 | 0.4 |
| Total Phosphorus-P | 3.3 | 6.6 | 5.0 |

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[a] See Appendix C for Station Description.

[b] All values reported as mg/l, except where otherwise specified.

[c] This discharge includes wastewater from residential areas. The flow from J. P. Stevens alone has been reported as 0.043 mgd.

## D. SUMMARY AND CONCLUSIONS

1. The J. P. Stevens Borden Plant discharges all wastewater to the Kingsport WWTP. However, during the survey, wastewater was overflowing to the South Fork of the Holston River because of a blocked interceptor line which was subsequently cleaned.

2. The occurrence of by-passing because of plugged sewers emphasize the need for development of a City maintenance program to provide routine inspection, cleaning, and repair on the sewerage system.

# E-IV. KINGSPORT MUNICIPAL WASTEWATER TREATMENT PLANT
KINGSPORT, TENNESSEE

## A. GENERAL

The Kingsport plant, located on Industry Drive adjacent to Reedy Creek [Figure IV-1], discharges to the South Fork of the Holston River (RM 2.16). The residential population served is about 24,000. However, at the present time this treatment plant also serves a working force of approximately 34,000 persons during the week. In addition to domestic wastes, the industrial waste sources discharging to the Kingsport WWTP include; the Slip-Not Belt Company (tanning firm), J. P. Stevens Borden Plant (processor of cotton goods), and the Kingsport Press Company. According to WWTP personnel, sanitary wastes from the Tennessee Eastman Company (TEC) occasionally include spills of process wastes which contain excessive floating and suspended solids and color. [Table E-18 identifies TEC toxic compounds discharged to Kingsport WWTP.]

Treatment of community wastes commenced in 1957 with a primary plant. The plant was upgraded in 1967 to a secondary facility with single-stage, high rate trickling filters. Construction of this and additional secondary treatment units was partially funded with Federal assistance under Public Law 660 funds (Project No. WPC-Tennessee-155). The plant was designed for a flow of 6.5 mgd and an organic load equivalent of a population of 65,000. The average influent flow to the plant is 6.59 mgd, with a BOD load of about 10,400 lb/day. Currently the plant is manned 18/hr/day, seven days per week, by four operators. An addi-tional operator is on call at all times.

Information and assistance was provided by Bob Collins, plant superintendent, and Lamar Dunn, sanitary engineer of the Tennessee State Board of Health.

## B. WASTE-TREATMENT FACILITIES

All raw wastes receive preliminary treatment that consists of screening, grit removal (two grit chambers in parallel, each 5 ft wide by 43 ft long), and pre-chlorination for odor control at the main pump station located on the north side of Reedy Creek [Figure E-4]. The bar screens are manually cleaned, and grit is removed mechanically. Screenings and grit are hauled to a sanitary landfill. Wastewater is pumped under Reedy Creek to the main plant site. Treatment facilities include:

| | |
|---|---|
| Primary sedimentation | two basins: each 40 ft wide, 120 ft long, 10 1/2 ft deep |
| High-rate trickling filters | two circular filters: each |
| Secondary clarification | two basins: each 80 ft wide, 110 ft long, 10 1/2 ft deep |
| Final disinfection basin (continuous gas application maintaining a 0.4-mg/l chlorine residual in the effluent to the South Fork of the Holston River) | one contact chamber: 47 ft wide, 59 ft long, 7 1/2 ft deep; and one gas chlorinator at 500 lb/hr |

Solids handling
a. Sludge thickner - - - - - - - - 12 ft dia. and 15 ft deep
b. Anaerobic digesters - - - - - - two each, 75 ft dia. and 26 ft deep
c. Holding ponds - - - - - - - - - two in series with 1-acre total surface area

The effluent from the secondary clarifier is continuously recirculated so that the trickling filters are operated at their maximum hydraulic capacity (13.5 mgd) thus minimizing the effects of shock loads in the

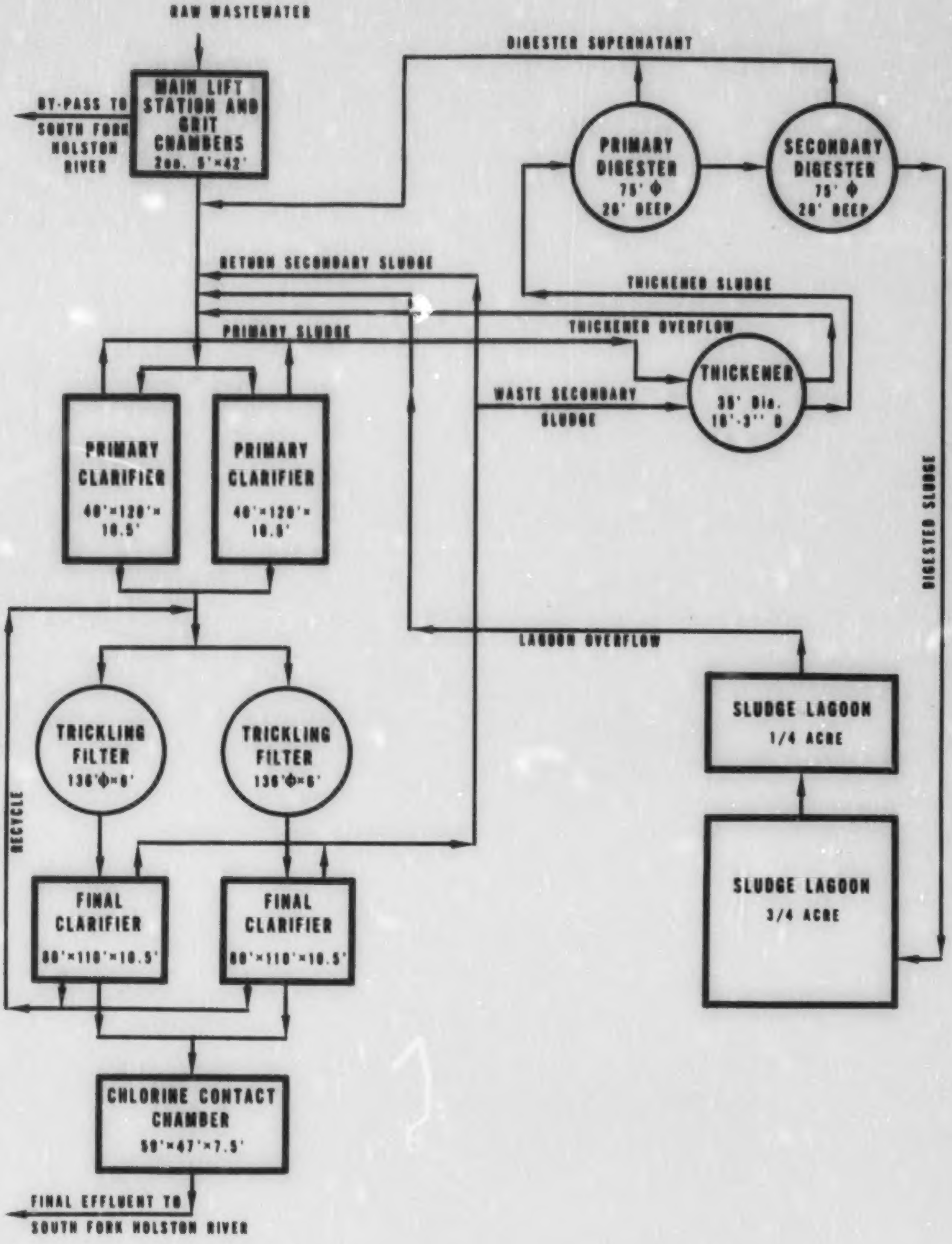
RAW WASTEWATER
MAIN LIFT STATION AND GRIT CHAMBERS 2ea. 5'×42'
BY-PASS TO SOUTH FORK HOLSTON RIVER
DIGESTER SUPERNATANT
PRIMARY DIGESTER 75' Φ 26' DEEP
SECONDARY DIGESTER 75' Φ 26' DEEP
RETURN SECONDARY SLUDGE
THICKENED SLUDGE
THICKENER OVERFLOW
PRIMARY SLUDGE
THICKENER 35' Dia. 10'-3'' D
WASTE SECONDARY SLUDGE
PRIMARY CLARIFIER 40'×120'×10.5'
PRIMARY CLARIFIER 40'×120'×10.5'
DIGESTED SLUDGE
LAGOON OVERFLOW
SLUDGE LAGOON 1/4 ACRE
TRICKLING FILTER 136'Φ×6'
TRICKLING FILTER 136'Φ×6'
RECYCLE
SLUDGE LAGOON 3/4 ACRE
FINAL CLARIFIER 80'×110'×10.5'
FINAL CLARIFIER 80'×110'×10.5'
CHLORINE CONTACT CHAMBER 59'×47'×7.5'
FINAL EFFLUENT TO SOUTH FORK HOLSTON RIVER

Figure E-4. Flow Diagram—Kingsport Municipal Wastewater Treatment Plant
Kingsport, Tennessee

plant influent. Primary sludge and a portion of the secondary settled sludge is pumped to the sludge thickener. The remainder of the secondary sludge is returned to the primary clarifiers. Sludge underflow from the thickener is discharged to the primary digester; the thickener overflow is returned to the primary clarifiers. Two stage anaerobic digestion is provided. The digested sludge is discharged to sludge lagoons for long-term storage. Digester supernatant and sludge lagoon overflow is returned to the primary clarifier. The lagoons have been in operation for two years, and the City anticipates an additional two years of use.

## C. PLANT OPERATION AND MAINTENANCE

Mr. Collins is a Class A (certified by State of Tennessee) operator and supervises one chief operator (with a Class A State certification) and three uncertified operators.* Part-time student help is available in the summer. Mr. Collins divides his time equally between the WWTP and the water treatment plant. In the case of an emergency or critical manpower needs, help is available from the water treatment plant. Plant personnel work nine-hr shifts. Two operators are present during the day and one at night; the plant is unattended from midnight to 6:00 a.m.

In 1971 plant operation and maintenance costs were $48,775. [Tables E-8 and E-9 list the routine operation and maintenance procedures followed by plant personnel. Table E-10 lists the analyses performed on the wastewater.] With one exception all laboratory analyses are performed at the plant laboratory; the coliform bacteria analyses are performed at the

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* The five-man staff does not meet the minimum qualifications established in the Federal guidelines for wastewater treatment plants.

## TABLE E-8

## OPERATION AND MAINTENANCE PROCEDURES KINGSPORT MUNICIPAL WASTEWATER TREATMENT PLANT

### FIRST-SHIFT SCHEDULE

1. Check entire plant for possible problems and go through the daily check list [Table E-9].

2. Correct any operating difficulties and clean up any unexpected messes, such as those from defective packing.

Monday----------Pick up trash along Industry Drive. During mowing season mow around the tight spots that are not easily mowed with the large mower. This mowing is to be down whether it is needed or not. Clear any weeds between the two buildings across the creek in the dirt fills. Sweep porches, walkways, steps etc. at all buildings.

Tuesday---------Grease and/or oil, all basin collectors, screens, grinders, drive chains, idlers, scum troughs, recycle troughs, grit collectors, etc. Clean trickling-filter arms and grease (one at a time). Replace any burned out light bulbs.

Wednesday-------Give all five piston pumps a thorough cleaning after replacing, adding or adjusting packing.

Thursday--------Clean digester building thoroughly. This includes a complete dusting.

Friday----------Scour and paint day -- pick out pieces of equipment to scour and paint such as final sludge pumps, recycle pumps, circulating pumps, or gas relief valves.

Saturday--------Run grit and clean completely the buildings across Reedy Creek and wash-down of the wet well, removing all rags and accumulations on the screens and grit collectors in the basement.

Sunday----------Clean the chlorine building, final pump house, and the primary pump house.

### SECOND-SHIFT SCHEDULE

1. Skim, change baskets, hose down, keep baskets in repair.

2. Perform lab work, enter all results.

## SECOND SHIFT SCHEDULE (Cont.)

3. Grind.

4. Clean office building daily, include work shop, porches, walks windows and without fail thoroughly clean the urinal, commode, and wash basin.

5. Record septic tank tickets.

6. Check entire plant and take care of any operating difficulties.

## TABLE E-9

## DAILY PLANT CHECK LIST
## KINGSPORT MUNICIPAL WASTEWATER TREATMENT PLANT

### PUMP HOUSE BUILDING ACROSS REEDY CREEK

1. If grinding is to be done, do this first to allow the grinders to clear themselves while checking the rest of the buildings.
2. Check shear pins and limit switches.
3. Rotate pumps.
4. Check water seal.
5. Check pumps for unusual noise, packing problems, stopping drain holes, an unusual amount of water on glands.
6. Make sure sump pump is working properly.

### DIGESTER BUILDINGS

1. Record digester level.
2. Record digester temperature.
3. Drain drip traps in valve room.
4. If supernatant is being removed, check for stoppage.
5. Check heaters.
6. Start thickener pump to see if it is stopped up.
7. See if thickener is turning, level o.k.? Sludge level too high? Record torque and hose down thickener.
8. Check sump pump.
9. Make sure circulating pumps are pumping by check valve rise and that the packing does not need attention.
10. Check piston pump operation and add oil to oilers.
11. Drain drip traps.
12. Record gas meter reading.
13. Light gas burners if needed.

### CHLORINE BUILDING

1. Make sure no chlorine is leaking. If leak is in evidence, shut off chlorine and repair immediately. For safety, leave the valve wrench on the cylinder which is being emptied.
2. Are machines feeding?
3. Record scale reading and decide if cylinder change is desired before morning.

### FINAL PUMP STATION

1. Check chart for proper operation of the raw and recycle pumps. If electrode operation of raw pumps is faulty, the electrodes should be cleaned without undue delay.
2. Change flow chart and record total flow reading.

## FINAL PUMP STATION (Cont.)

3. Check compressors for faulty operation.
4. Shut off sample pump for backflushing after setting up for chlorine test. Change sample jars, place sampler back in operation, clean dipper, pour out dirty water and record chlorine reading.

## PRIMARY PUMP STATION

1. Operate each sludge pump to see if each will raise the check valve.
2. Shut off flow to the sampler and open the by-pass on the second sampler to flush the line. Replace the sample jars with clean ones, place samplers back in operation, clean dippers rinse, and pour out rinse water.
3. Check water seal units, packing on sludge pumps, drainage.
4. Sump pump operation.
5. Store samples in refrigerator.

## OFFICE

1. Make entrees on the monthly report sheet.
2. Remove dry dishes from the drying oven so that they will be ready for weighing.

## TABLE E-10

## KINGSPORT MUNICIPAL WASTEWATER TREATMENT PLANT
## FREQUENCY OF LABORATORY ANALYSES
## SAMPLING LOCATION AND NUMBER OF SAMPLES ANALYZED PER WEEK

| Parameter | Raw Wastewater | Primary Effluent | Final Effluent | Digester Supernatant | Digested Sludge | Receiving Stream |
|---|---|---|---|---|---|---|
| BOD | 7[a] | 7 | 7 | | | 1 |
| Suspended Solids | 7 | 7 | 7 | | | 1 |
| Settleable Solids | 7 | 7 | 7 | | | 1 |
| Dissolved Oxygen | 7 | 7 | 7 | | | 1 |
| Total Solids | 7 | 7 | 7 | | | 1 |
| pH | 7 | 7 | 7 | 7 | | 1 |
| Temperature | 7 | | | 7 | 7 | 1 |
| Coliform Density | | | 1 | | | 1 |
| Residual Chlorine | | | 7 | | | |
| Volatile Acids | | | | 7 | | |
| Alkalinity | | | | 7 | | |

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[a] Where seven analyses are made per week, one analysis is made each day.

Sullivan County Health Department Laboratory. Industrial waste sources are not sampled because the staff cannot handle this additional work load.

## D. DISCUSSION

The Kingsport WWTP was not sampled during the survey because of hydraulic overloading due to combined sewers; the plant was by-passing to the South Fork of the Holston River. The by-passing commenced about 0700 hr, 10 December, and continued until about 1300 hr, 14 December. The influent and effluent data collected during this period would not be representative of plant operations under dry-weather flow.

A summary of plant records, for the period of November 1971 through November 1972, for waste removals at the plant indicate that:

a) influent BOD was reduced by about 70 percent; and

b) influent suspended solids (SS) were reduced by 74 percent.

The average effluent BOD and suspended-solids levels were 57 mg/l (3,130 lb/day) and 36 mg/l (2,190 lb/day), respectively, which does not meet the requirements of secondary treatment that have been proposed pursuant to the Federal Water Pollution Control Act Amendments of 1972.* The 1969 FWQA survey measured an average effluent BOD and SS load of 500 lb/day and 440 lb/day, respectively. To ensure that the water-quality criteria established by the State of Tennessee for the Holston River and the South Fork of the Holston River be maintained and that the DO concentration in the receiving waters be maintained at 3.0 mg/l, the 1969 report recommended the Kingsport WWTP effluent not exceed

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* The EPA is currently proposing to limit BOD and SS, in the effluent, to a monthly average of 30 mg/l and to a weekly average of 45 mg/l, or 85 percent overall reduction, whichever produces better quality effluent.

900 lb/day BOD. However, to maintain the official standard of 5.0 mg/l minimum DO, the effluent should not exceed 500 lb BOD/day.

With the current practice of recirculating secondary-clarifier overflow the overflow rate from the secondary clarifiers, at 13.5 mgd flow, is 770 gpd/ft$^2$. If the flow was recirculated to the filters before secondary clarification, the overflow rate, at 6.59 mgd (average daily flow), would be 380 gpd/ft$^2$. This lower overflow rate would be expected to reduce the BOD and suspended solids in the final effluent.

The wet-weather flow is almost double the dry-weather flow. [Table E-11 lists the average monthly data selected for the high- and low-flow months, from November 1971 to November 1972.]

TABLE E-11

PLANT PERFORMANCE DATA FOR HIGH
AND LOW-FLOW MONTHS, NOV. '71-NOV. '72
KINGSPORT WASTEWATER TREATMENT PLANT
KINGSPORT, TENNESSEE

| Average Monthly | Maximum-Flow Month April/1972 | Minimum-Flow Month Nov./1971 |
|---|---|---|
| Flow (mgd) | 8.64 | 4.44 |
| Settleable Solids (ml/l) | | |
| Influent | 3.5 | 3.7 |
| Effluent | T* | T |
| % Removal | ~100 | ~100 |
| Suspended Solids (mg/l) | | |
| Influent | 178 | 166 |
| Effluent | 44 | 32 |
| % Removal | 75.2 | 80.7 |
| BOD (mg/l) | | |
| Influent | 145 | 192 |
| Effluent | 64 | 47 |
| % Removal | 55.8 | 75.6 |

* T indicates trace amounts present.

By-passing to the South Fork of the Holston River occurs automatically at the plant when the raw, wastewater flow exceeds 13 mgd. Sewer overflows also occur within the sewerage system when individual sewers and lift stations exceed normal carrying capacity. The large increase in the wet-weather flow is from combined sewers. The City has no plans to mitigate these problems.

Plant operational problems have occurred due to the wastes from several industries connected to the City sewers -- in particular, Slip-Not Belt Company and TEC. Plant personnel reported toxic materials and highly colored wastewaters from Slip-Not which together with large quantities of suspended and floating solids from TEC have been responsible for operational difficulties. The digesters became inoperative in late 1971 and to date the cause of the malfunction has not been identified. During the 1972 survey organic compounds were identified in the TEC sanitary wastewaters [Section E-VII]. These compounds may be toxic to biological treatment systems or pass through untreated. Plant personnel are confident that overall plant performance would improve if the City enforced its Industrial Waste Ordinance No. 1539 [Appendix F]. The ordinance requires pretreatment of high organic and suspended solids wastes (>300 mg/l BOD, >350 mg/l SS and that toxic substances (iron, copper, lead, zinc, etc.) be limited in quantity so that the total contribution will not cause interferance in normal plant operations.

A sewer maintenance program is necessary in the City of Kingsport. On one occasion during the survey, a blocked interceptor resulted in industrial wastewaters (from J. P. Stevens Company) and domestic raw sewage to be by-passed directly to the river.

## E. SUMMARY AND CONCLUSIONS

1. The Kingsport WWTP was not sampled because of hydraulic overloading due to the combined sewer flow. The plant by-passed raw sewage and storm-water runoff to the South Fork of the Holston River during the period 10 through 14 December 1972.

2. Plant records indicate that the BOD and suspended solids are reduced by 70 percent and 74 percent, respectively, during normal operating conditions. The effluent contained an average of 57 mg/l (3,130 lb/day) BOD and 36 mg/l (2,190 lb/day) suspended solids, which does not meet the requirements for secondary treatment that have been proposed pursuant to the 1972 Amendments to the Federal Water Pollution Control Act. (EPA proposes to limit BOD and SS, in the effluent to a monthly average of 30 mg/l and to a weekly average of 45 mg/l, or 85 percent overall reduction, whichever produces better quality. This level of treatment is beyond the capability of the plant.)

3. The 1969 FWQA survey recommended that the Kingsport Wastewater Treatment Plant effluent not exceed 900 lb/day BOD (92 percent removal) to ensure that a minimum of 3.0 mg/l of DO is maintained in the Holston River and the South Fork of the Holston River. To maintain the official standard of 5.0 mg/l minimum DO, the effluent should not exceed 500 lb BOD/day (95.5 percent removal).

In the interim, until adequate facilities are constructed, some improvement in treatment could be realized by changing the method of recirculation to the trickling filter and by enforcement of the City industrial waste ordinance.

## F. RECOMMENDATIONS

It is recommended that City officials be formally advised that:

1. In order to maintain a minimum concentration of 5.0 mg/l DO in the Holston River, the BOD in the effluent shall not exceed 500 lb/day, and the suspended solids shall not exceed 500 lb/day. Additional effluent requirements established by the State of Tennessee shall be met.

2. The fecal-coliform bacterial density in the effluent shall not exceed 200/100 ml, as a monthly average, and 400/100 ml, as a weekly average.

3. The industrial waste ordinance for the City shall be modified to meet the requirements for pretreatment when published in accordance with the Federal Water Pollution Control Act Amendments of 1972.

4. Corrective measures shall be taken to preclude the by-passing of untreated wastes from the plant or within the sewerage system due to excessive combined sewer flows, and a sewer maintenance program shall be developed to routinely inspect, clean and repair sewers and thus preclude direct by-passing resulting from plugged lines, etc.

5. A schedule and proposed method of treatment for achieving the necessary pollution abatement be provided EPA, Region IV, by 15 October 1973.

## E-V. MEAD PAPERS, DIVISION OF MEAD CORPORATION
## KINGSPORT, TENNESSEE

### A. GENERAL

Mead Papers (a division of the Mead Corporation), an integrated Kraft Mill, manufactures 250 tons/day of pulp by the hot soda process. The raw materials include cord wood and wood chips (waste products from saw mills, furniture manufacturers, etc.). Mead Papers also imports about 40 tons/day of short fiber pulp from the Mead plant in Chillicothe, Ohio, and 200 tons/day of long fiber pulp from a plant in Brunswick, Georgia, which is jointly owned by Mead and the Scott Paper Company. The pulps are combined to produce about 460 tons/day of paper, half of which is sold in rolls and half, in sheets, to the printing industry. Fillers, used in the processes, include kaolin, calcium carbonate, titanium dioxide, copper silicate, and diatomaceous earth. The plant operates continuously and employs 1,075 people.

A RAPP* application, filed in December 1971, lists four storm-water outfalls and one process wastewater outfall.

EPA personnel conducted an in-plant survey on 1 through 3 December 1972. George Clark, manager of quality assurance, provided information and assistance.

### B. WASTE SOURCES AND TREATMENT

The company pumps approximately 17.8 mgd of water from the South Fork of the Holston River and purchases an additional 0.26 mgd from the

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* The 1972 Amendments stipulate that the Refuse Act permit applications be processed through the National Pollutant Discharge Elimination System (NPDES).

City of Kingsport. Approximately 18 mgd is used as process water, and the remainder for sanitary purposes.

Discharges to the river include flows from the pulping, bleaching, and paper-making operations, wastes from the water-treatment plant (including spent sulfuric acid and caustic regenerants from the demineralizers), and cooling water from two direct-contact condensers. (One condenser is on the black-liquor evaporator and one is used to condense the steam released when a pulp digester is blown down.) The flow in these two condensers contributes about 10 percent of the total BOD leaving the plant. In 1973 the company intends to replace these condensers with non-contact condensers.

Approximately 17 mgd of the wastewater is treated in a 150-ft dia. clarifier (overflow rate: 960 gpd/sq ft) before combining with untreated wastes, including water-treatment plant wastes [Figure E-5]. The combined flow is discharged to the South Fork of the Holston River (RM 142.15/2.5) (Station 41: RAPP Serial No. 001). The sludge from the clarifier is concentrated to 40 percent solids by centrifugation and hauled to a landfill on the plant property.

Data, submitted to the State of Tennessee for the period May-October 1972, showed that the clarifier effluent had the following characteristics:

| Parameter | Range | Average |
|---|---|---|
| BOD, mg/l | 75-186 | 120 |
| SS, mg/l | 657-1,078 | 860 |
| Color, color units | 300-1,100 | 675 |

The company is constructing an aerated lagoon to treat the wastewater leaving the clarifier. The lagoon is to have a surface area of 23 acres, by 12 ft deep, and provide a five-day detention time. The lagoon will be aerated using eight 60-hp surface aerators. There are no plans to build a sedimentation unit for clarification of the lagoon effluent. The predicted quality of the lagoon effluent, reported in the RAPP application, is as follows:

| Parameter | Concentration, mg/l | Load, lb/day |
|---|---|---|
| BOD | <42 | <6,000 |
| COD | <85 | <12,000 |
| SS | 110 | 15,600 |
| Total Kjeldahl Nitrogen | 10 | 1,420 |
| Aluminum | 4 | 570 |
| Copper | <0.1 | <15 |
| Zinc | <0.2 | <30 |
| Phenolics | 0.15 | 22 |

The stream of process wastes entering the river is dark brown in color and has a significant amount of foam on the surface. The company is planning to incorporate a de-foaming process and to install a submerged diffuser effluent pipe across the river to improve the dispersion of the wastes.

Spent cooking liquors are evaporated and incinerated in order to recover sodium carbonate and sodium hydroxide. By the use of lime (CaO) the carbonate is then converted to caustic; the calcium carbonate formed is filtered and oxidized, in a lime kiln, to calcium oxide.

Process wastes, previously discharged to a pond containing black

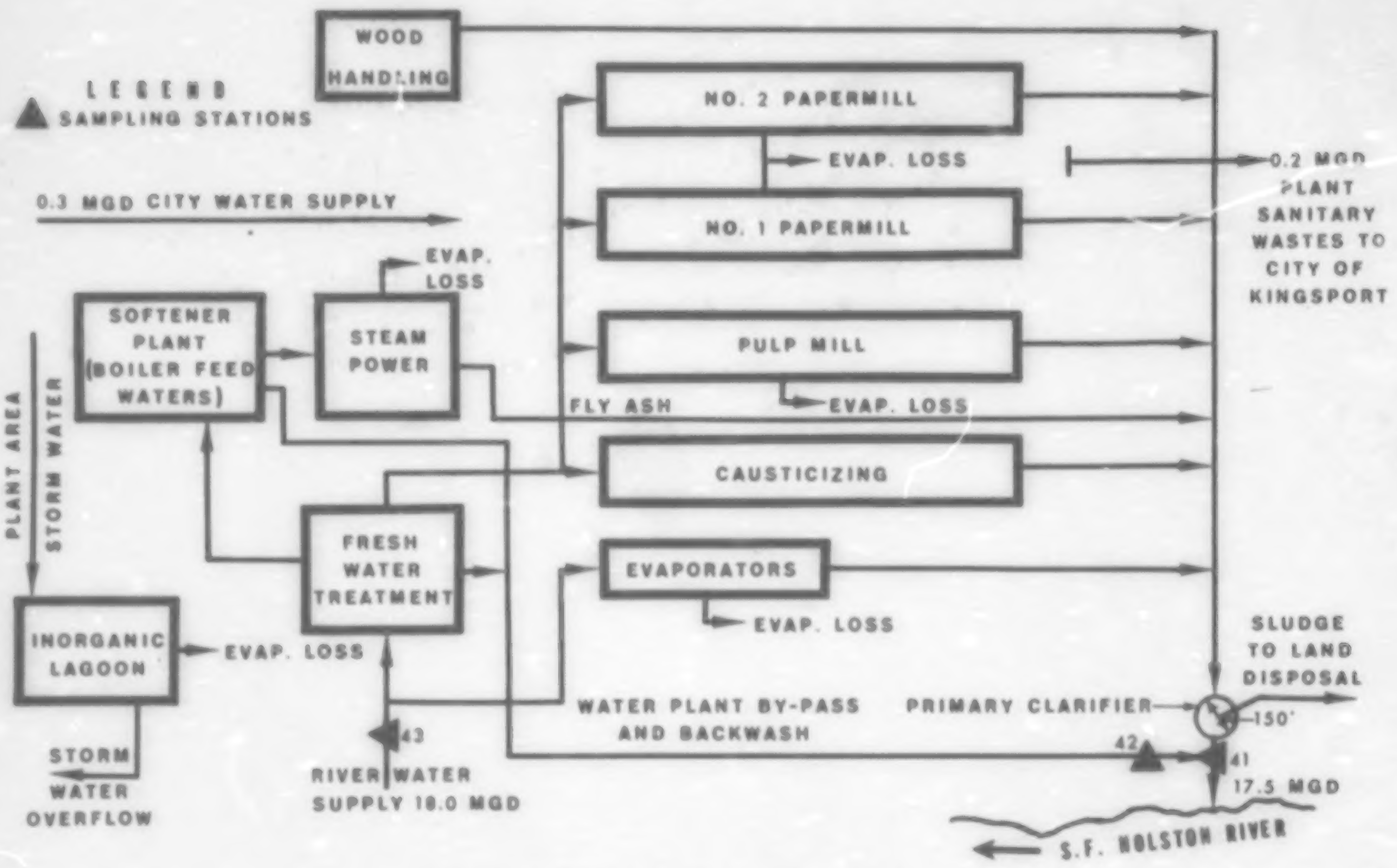
LEGEND
SAMPLING STATIONS
WOOD HANDLING
0.3 MGD CITY WATER SUPPLY
NO. 2 PAPERMILL
EVAP. LOSS
NO. 1 PAPERMILL
0.2 MGD PLANT SANITARY WASTES TO CITY OF KINGSPORT
SOFTENER PLANT (BOILER FEED WATERS)
STEAM POWER
EVAP. LOSS
PULP MILL
EVAP. LOSS
FLY ASH
CAUSTICIZING
PLANT AREA
STORM WATER
FRESH WATER TREATMENT
EVAPORATORS
EVAP. LOSS
INORGANIC LAGOON
EVAP. LOSS
SLUDGE TO LAND DISPOSAL
WATER PLANT BY-PASS AND BACKWASH
PRIMARY CLARIFIER
150'
43
42
41
STORM WATER OVERFLOW
RIVER WATER SUPPLY 18.0 MGD
17.5 MGD
S.F. HOLSTON RIVER

Figure E-5. Flow Diagram—Mead Papers
Kingsport, Tennessee

liquor (the pond effluent being formerly RAPP Serial Number 004), have been diverted to the industrial waste outfall (001). However, the pond still receives storm runoff. The pond could discharge to the river during wet weather through an overflow structure.

Sanitary wastes (0.2 mgd) are discharged to the Kingsport WWTP.

## C. PLANT EVALUATION AND FINDINGS

The effluent from the clarifier and the waste stream joining this effluent were each sampled for three days with automatic samplers, supplied by the Mead Paper Company, and composited continually over a 24-hr period. Three grab samples for oil-and-grease analysis were manually collected daily over a 4-to-6-hr period and composited on an equal-volume basis. The river intake water was sampled with SERCO automatic samplers, and the samples composited on an equal-volume basis at the end of 24 hr. Temperature, pH, and conductivity measurements were made at least three times per day. Effluent flows were obtained from the company flow recorders installed at the Parshall flumes of Mead Papers. [Chemical data and field measurements are summarised in Table E-12.]

The effluent from the clarifier (16. mgd) had an average BOD of 160 mg/l and suspended solids of 226 mg/l. The suspended-solids concentration was considerably less than the values (860 mg/l) reported by the company to the State; the BOD was within the reported range. The pH ranged from 6.4 to 10.0.

The untreated waste stream had an average flow of 1.4 mgd and a pH range of 2.4 to 7.2. Because the waste stream combines with the clarifier

## TABLE E-12

## SUMMARY OF FIELD MEASUREMENTS AND CHEMICAL DATA
MEAD PAPERS, DIVISION OF MEAD CORPORATION
KINGSPORT, TENNESSEE
1-3 DECEMBER 1972

| Station Number | 41 | | 42 | | 43 | |
|---|---|---|---|---|---|---|
| Station Description[a] | Clarifier Effluent (RM 142.15/2.5) | | Water Treatment Backwash (RM 142.15/2.5) | | Water Intake (RM 142.15/2.6) | |
| Parameter[b] | Range | Average | Range | Average | Range | Average |
| Flow (mgd) | 15.9-16.4 | 16.1 | 1.32-1.56 | 1.4 | | 17.8[c] |
| pH (standard units) | 6.4-10.0 | | 2.4-7.2 | | 6.3-7.9 | |
| Temperature (°C) | 28.0-32.0 | | 17.0-25.5 | | 11.0-18.5 | |
| Conductivity (µmhos/cm) | 1,000-1,400 | | 280-1,650 | | 160-240 | |
| BOD | 160[d] | 160 | 2.6-6.3 | 4.3 | 5.3-7.1 | 6.2 |
| BOD (lb/day) | | 21,500 | | 51 | | 920 |
| COD | 275-326 | 299 | 44[e] | | | |
| TOC | 114-120 | 118 | 8-12 | 10.0 | 4-6 | 5.3 |
| Total Solids | 1,110-1,180 | 1,150 | 362-393 | 380 | 140-158 | 151 |
| Suspended Solids | 214-246 | 226 | 93-120 | 102 | 3-35 | 16 |
| Suspended Solids (lb/day) | | 30,300 | | 1,200 | | 2,400 |
| Total Kjeldahl Nitrogen-N | 3.3[e] | | <0.5-0.5 | <0.5 | N.D. | |
| Total Kjeldahl Nitrogen-N (lb/day) | | 451 | | | | |
| $NH_3$-N | 1.2[e] | | N.D. | | N.D. | |
| $NH_3$-N (lb/day) | | 164 | | | | |
| $NO_2$ + $NO_3$-N | N.D.[f] | | 1.1[d] | | 0.8-0.9 | 0.8 |
| $NO_2$ + $NO_3$-N (lb/day) | | | | 14.3 | | 126 |
| Total Phosphorus-P | 0.55[e] | | 0.29-0.32 | 0.3 | 0.07-0.17 | 0.12 |
| Total Phosphorus-P (lb/day) | | 73 | | | | 17.8 |
| Oil and Grease | 2-6 | 4 | 1-3 | 2 | | |

---

a/ See Appendix C for Station Description.
b/ All values reported as mg/l, except where otherwise specified.
c/ The flow was determined from RAPP application.
d/ All values are the same.
e/ This is based on one value.
f/ N.D. - None Detected.

effluent, the low pH is neutralized before discharge to the river. The BOD and suspended solids averaged 4.3 mg/l and 102 mg/l, respectively.

The combined daily wasteload discharged contained 21,600 lb of BOD (148 mg/l), 31,500 lb of suspended solids (216 mg/l), and 451 lb of total Kjeldahl-nitrogen (3.3 mg/l). These BOD and suspended-solids loads are equivalent to 47 lb and 68.5 lb/ton of product, respectively. During the survey the waste stream to the river was dark brown in color and had a significant amount of foam on the surface.

The 1969 FWQA study reported an effluent quality similar to that observed in 1972. The BOD, suspended solids, and total Kjeldahl-nitrogen measured 168, 160 and 2.9 mg/l, respectively. The quality of the backwash from the water-treatment plant was not measured during the 1969 survey.

As discussed previously, a 23-acre aerated lagoon (eight 60-hp surface aerators) designed to treat the primary clarifier effluent was under construction at the time of the 1972 survey. The company also plans to install a defoaming process and construct a submerged diffuser across the river to provide better distribution. The State of Tennessee orally informed the company that the waste load must be reduced to 6,000 lb/day maximum (13 lb/ton of product). However, the State has not established an implementation date or put this requirement in writing. Officials of Mead Papers indicated that, if the aerated lagoon performs as anticipated, the effluent will meet the 6,000 lb of BOD/day requirement.

EPA interim Effluent Guidelines have been established for the pulp and paper industry based on best practicable control technology. These effluent limitations require that the BOD and suspended solids not exceed 9 lb/ton* of product each (28 mg/l of each at present flow of 17.5 mgd). However, these limits are not stringent enough for this plant. The 1969 study determined that in order to maintain a minimum concentration of 3.0 mg/l of DO in the Holston River and to protect the receiving waters, the BOD load should not exceed 2,000 lb/day (4.4 lb/ton of product). However, to maintain a minimum concentration of 5.0 mg/l of DO, the official standard, the BOD in the effluent should not exceed 1,100 lb/day (2.4 lb/ton). To reduce the BOD to this level would require additional facilities.

## D. SUMMARY AND CONCLUSIONS

1. Mead Papers, an integrated Kraft Mill, discharges approximately 17.5 mgd of process wastes containing 21,550 lb of BOD (39.9 lb/ton of product), and containing 31,500 lb of suspended solids (68.5 lb/ton), and 450 lb of total Kjeldahl-nitrogen to the South Fork of the Holston River. The lagoon system under construction is designed on the basis of meeting an effluent limit of 6,000 lb/day of BOD. The present system might not meet requirements for best practicable treatment currently available or the requirements of the water-quality standards. The 1969 study determined that in order to maintaine a minimum DO concentration of 3.0 mg/l in the Holston River, the BOD load must not exceed 2,000 lb/day (4.4 lb/ton of product). To meet the existing standard of 5.0 mg/l DO the BOD in the effluent should not exceed 1,100 lb/day (2.4 lb/ton).

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* The limit for Kraft pulping and manufacturing of bleached grades was used for half the production, and the limit for manufacturing "fine" paper from purchased pulp for the other half of production was used in the calculation of this value.

E-48a

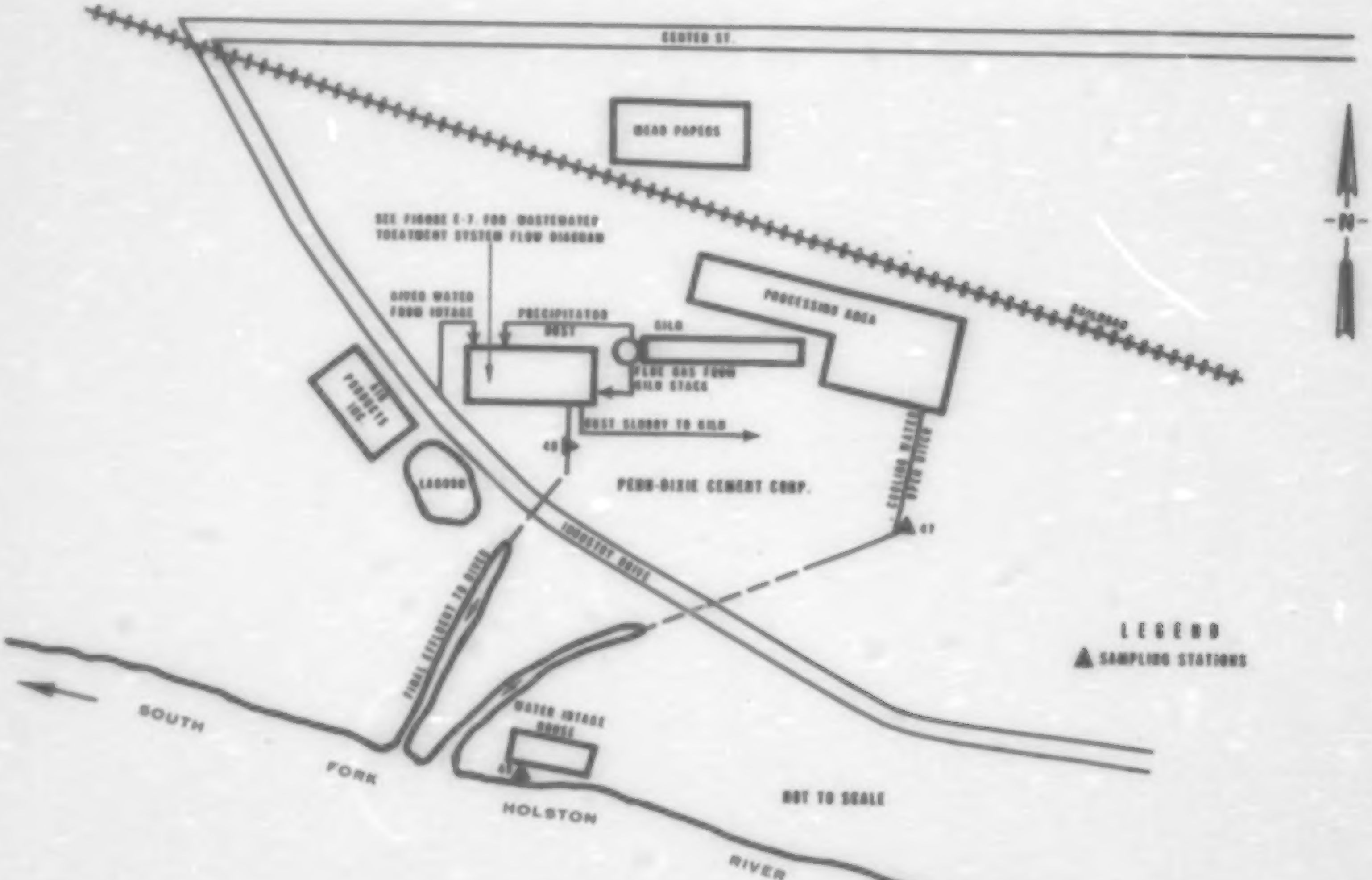
N
CENTER ST.
MEAD PAPERS
RAILROAD
SEE FIGURE E-7 FOR WASTEWATER TREATMENT SYSTEM FLOW DIAGRAM
RIVER WATER FROM INTAKE
PRECIPITATOR DUST
SILO
PROCESSING AREA
FLUE GAS FROM KILN STACK
DUST SLURRY TO KILN
AIR PRODUCTS INC.
LAGOON
46
PENN-DIXIE CEMENT CORP.
COOLING WATER OPEN DITCH
47
INDUSTRY DRIVE
FINAL EFFLUENT TO RIVER
WATER INTAKE HOUSE
LEGEND
▲ SAMPLING STATIONS
SOUTH
FORK
HOLSTON
RIVER
NOT TO SCALE

Figure E-8. Plant Layout-Penn-Dixie Cement Corporation

Kingsport, Tennessee

## E. RECOMMENDATIONS

It is recommended that:

1. To maintain a minimum concentration of 5.0 mg/l DO in the Holston River, the BOD in the effluent shall not exceed 1,100 lb/day. The suspended solids shall not exceed 1,100 lb/day above background levels; the pH shall be within the range of 6.0 to 9.0 at all times.

2. All additional effluent regulations established by the Sate of Tennessee shall be met.

3. The aerated lagoon under construction shall receive all process wastes and there shall be no discharge of wastes from the water-treatment plant without adequate treatment.

4. The effluent structure from the black-liquor pond shall be sealed, and all storm water be diverted around the lagoon so that the contents of the pond are not released.

5. A schedule and proposed method of treatment for achieving the necessary pollution abatement be provided to EPA, Region IV, by 15 October 1973.

## E-VI. THE PENN-DIXIE CEMENT CORPORATION KINGSPORT, TENNESSEE

### A. GENERAL

The Penn-Dixie Cement Corporation, Kingsport Plant, produces portland cement for local use (in the construction industry). The plant [Figure E-6] operates continuously: 123 people are employed. Approximately 1,550 tons per day of limestone, shale, and sand are mixed with raw water from the South Fork of the Holston River and ground to about 38 percent moisture. This mixture is calcinated at 2,700°F in a horizontal kiln (500 ft long by 12 ft in dia.) to produce clinkers. The clinkers are dry ground to produce an average of 940 tons per day of cement.

Limestone is hauled by rail from Virginia, shale is quarried locally, and sand is purchased from North Carolina. Six million cu ft of gas are required to run the kiln during the warm months. Ground coal is used in the winter due to a shortage of gas.

A RAPP application* has been submitted for the wastewater discharge from the air-and-solids waste-treatment system. The State also granted a discharge permit for a five-yr period that terminates 21 January 1974.

EPA personnel visited the plant on 10 through 12 December 1972. Information and assistance was provided by A. J. Snyder, plant manager.

### B. WASTE SOURCES AND TREATMENT

The Company reported that municipal water is used in the plant at the rate of 0.4 mgd. About 3,500 gpd is employed for sanitary purposes and discharged to the Kingsport WWTP. The remainder is used for external cooling of process equipment bearings, the kiln coal burner pipe, and the cement.

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* The Federal Water Pollution Control Act Amendments of 1972 stipulate that the Refuse Act permit applications be processed through the National Pollutant Discharge Elimination System (NPDES).

Approximately 0.55 mgd of water is pumped from the South Fork of the Holston River. Most of this water, used for the wet grinding of raw materials, evaporates in the kiln. River water is sometimes used for cooling, but its poor quality makes it undesirable for this purpose. There is no recycling of water within the plant. The second major use of river water (approximately 0.25 mgd) is in the air-and-solids waste-treatment system [Figure E-7] described in the following paragraphs.

The high concentrations of soluble alkalis in the dust from the kiln electrostatic precipitator make it unsuitable for immediate recycle to the kiln. The dust is, therefore, mixed with water in a slurry tank (6 ft dia. by 6 ft deep) and pumped into a thickener tank (45 ft dia. by 10 ft deep). Thickened solids (underflow) are returned to the kiln, and the overflow is channeled into a carbonation tank.

Kiln stack flue gas, which has been scrubbed and compressed is bubbled through the carbonation tank at a controlled rate in order to lower the pH. The effluent from the carbonation tank flows to a clarifier (32 ft dia. by 12.5 ft deep). The clarifier effluent is recarbonated to a pH of 7.8, before being discharged to the river [Figure E-6, Station 48]. The sludge is recycled to the thickener.

Under optimum operating conditions 1,050 tons of precipitator dust are treated per month. The thickener-tank influent solids have a

90-percent moisture content, and the thickener sludge, returned to the kiln, has a moisture content of 75 percent. If the thickener is down or being cleaned, untreated wastewater flows to the river.

Penn-Dixie collects one grab sample of this discharge three days a week and submits data on pH, total hardness, sodium, total and settleable solids, sulfate, and turbidity to the Tennessee Stream Pollution Control Division [Table E-13].

The second discharge from Penn-Dixie to the South Fork of the Holston River is cooling water (Station 47). The waste stream flows in an open ditch through plant property, then, into a culvert, as it leaves the property at the Industry Drive border. At the time of the plant visit by EPA, company officials could not provide information on the final disposition of this waste stream after it left plant property.

Therefore, during the survey, EPA personnel introduced Rhodamine WT 20 dye into the cooling-water discharge. Thirty minutes later the dye was observed discharging from a 36-in. concrete outfall (Station 47) located between Penn-Dixie and Air Products, an industrial facility adjacent to the Penn-Dixie plant. Penn-Dixie was informed that this discharge would require a NPDES permit.

Presently, Penn-Dixie is applying for an EPA grant to develop a pilot-plant project for pumping alkalai wastes to Mead Papers, a company located close to the Penn-Dixie plant. The plan calls for these wastes to be used in decolorizing wastes from the pulping operation at Mead. The resultant mixture will be settled, and the effluent used

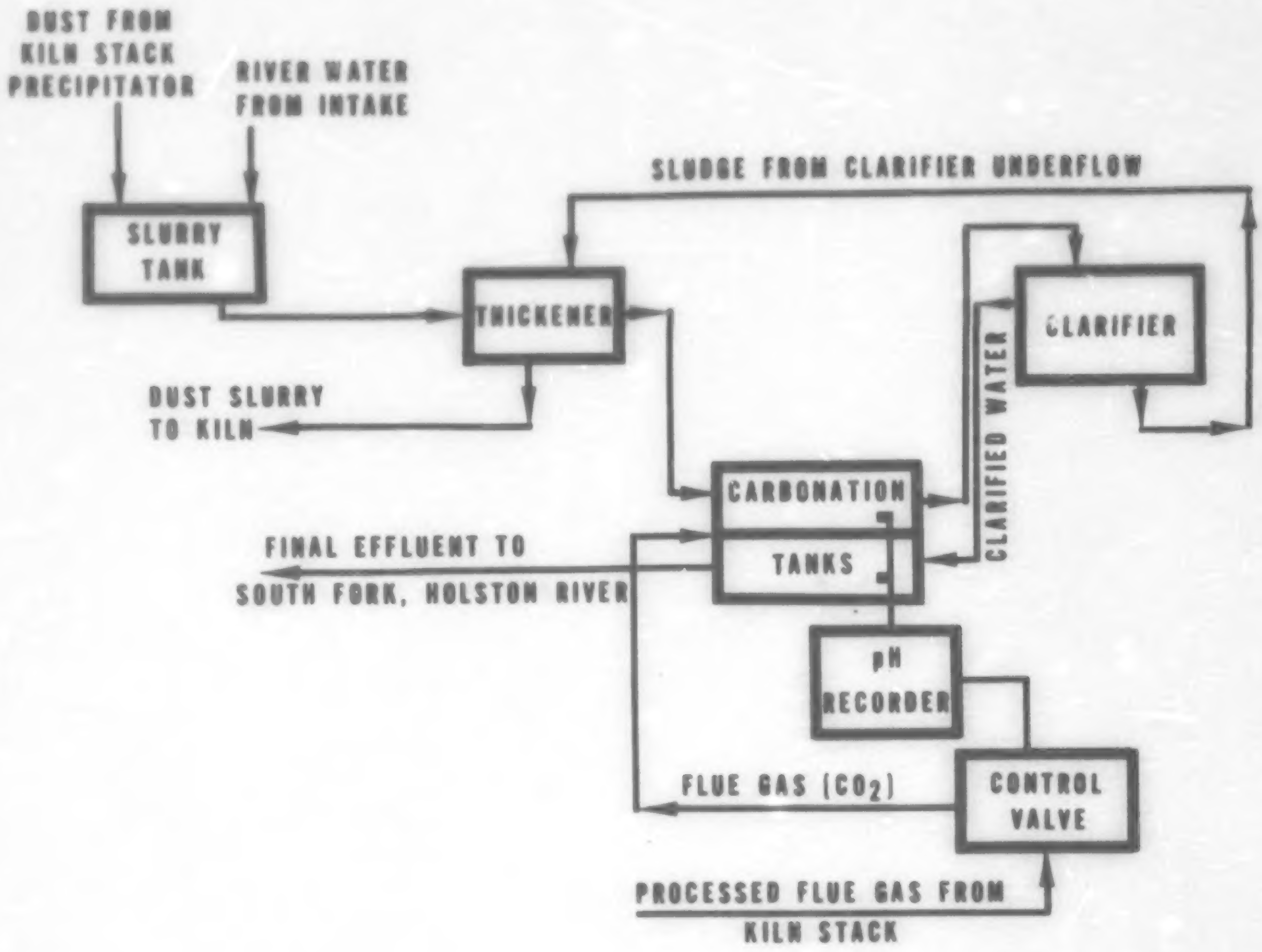
DUST FROM KILN STACK PRECIPITATOR
RIVER WATER FROM INTAKE
SLURRY TANK
THICKENER
DUST SLURRY TO KILN
SLUDGE FROM CLARIFIER UNDERFLOW
CLARIFIER
CLARIFIED WATER
CARBONATION
TANKS
FINAL EFFLUENT TO SOUTH FORK, HOLSTON RIVER
pH RECORDER
CONTROL VALVE
FLUE GAS (CO2)
PROCESSED FLUE GAS FROM KILN STACK

Figure E-7. Wastewater Treatment System Flow Diagram-Penn-Dixie Cement Corporation

Kingsport, Tennessee

## TABLE E-13

## DATA SUBMITTED TO THE STATE OF TENNESSEE DEPARTMENT OF PUBLIC HEALTH BY PENN-DIXIE CEMENT CORPORATION

| 1972 | Flow 1000 gpd | pH | Total Hardness $CaCO_3$ mg/1 | Sodium mg/1 | Total Solids mg/1 | Sulfate mg/1 | Turbidity JTU | Settleable Solids ml/1 |
|---|---|---|---|---|---|---|---|---|
| May | | | | | | | | |
| Average | 210 | | 560 | 274 | 8390 | 3760 | 23 | 0.0 |
| Range | 3-252 | 7.1-7.9 | 220-890 | 0-465 | 1120-11760 | 450-5328 | 10-50 | 0.0 |
| June | | | | | | | | |
| Average | 185 | | 506 | 479 | 15059 | 4482 | 30 | 0.0 |
| Range | 60-216 | 7.2-7.8 | 300-760 | 250-900 | 8234-24708 | 3690-5642 | 10-50 | 0.0 |
| July | | | | | | | | |
| Average | 171 | | 288 | 411 | | 3938 | 34 | 0.0 |
| Range | 60-216 | 7.0-8.9 | 160-410 | 155-760 | | 2649-5107 | 10-50 | 0.0-0.2 |
| August | | | | | | | | |
| Average | 174 | | 292 | 785 | 38801 | 4128 | 50 | 0.0 |
| Range | 72-202 | 7.2-8.6 | 160-470 | 165-1300 | 6996-59760 | 2815-5116 | 50 | 0.0 |
| September | | | | | | | | |
| Average | 167 | | 480 | 542 | 22410 | 3864 | 37 | 0.0 |
| Range | 60-180 | 7.1-8.1 | 230-1000 | 40-1000 | 1212-39636 | 617-5294 | 20-50 | 0.0 |
| October | | | | | | | | |
| Average | 173 | | 464 | | | 4389 | 50 | 0.0 |
| Range | 72-216 | 6.8-8.8 | 170-750 | | | 3225-5223 | 50 | 0.0 |

for scrubbing $SO_2$ out of the Mead stack gas. Then, all sludges from the Mead Papers primary clarifier will be sent to Penn-Dixie for use in the kiln. However, a final decision has not been made on this plan.

## C. PLANT EVALUATION AND FINDINGS

The Penn-Dixie Cement Corporation was sampled for three days using SERCO automatic samplers in order to collect hourly samples from the two discharges and the intake water. The samples were composited on an equal-volume basis at the end of each 24-hour period. Grab samples for oil and grease were collected manually three times a day over a 4-to-6 hr period and composited on an equal-volume basis. Temperature, pH, and conductivity were measured at least three times per day. Flows were also measured by NFIC-D personnel. [Chemical data and field measurements are summarized in Table E-14.]

The effluent (0.284 mgd) from the air-solids waste-treatment system (Station 48) contained 62 lb/day of suspended solids. However, data from the permit application and the data submitted by the company to the Tennessee Department of Public Health disclose that the solids concentration normally exceeds the levels found at the time of the survey.

AIR-SOLIDS WASTEWATER EFFLUENT DATA

| | RAPP Application 22 June 1972 | State of Tennessee May-Oct. 1972 | EPA Survey 10-12 Dec. 1972 |
|---|---|---|---|
| Average flow, gpd | 380,000 | 180,000 | 284,000 |
| Total Solids, mg/l | 8,120 | 2,120 | 756 |
| Suspended Solids, mg/l | 160 | | 31 |

The discharge (Station 47) of cooling water (0.49 mgd) contained an average of 1,750 lb of suspended solids/day, almost 30 times that observed

## TABLE E-14

### SUMMARY OF FIELD MEASUREMENTS AND CHEMICAL DATA
PENN-DIXIE CEMENT CORPORATION
KINGSPORT, TENNESSEE
6-8 DECEMBER 1972

| Station Number | 47 | | 48 | | 49 | |
|---|---|---|---|---|---|---|
| Station Description[a] | Cooling Water (RM 142.15/2.6) | | Process Waste and Cooling Water (RM 142.15/2.7) | | Water Intake (RM 142.15/2.75) | |
| Parameter[b] | Range | Average | Range | Average | Range | Average |
| Flow (mgd) | 0.46-0.51 | 0.49 | 0.21-0.35 | 0.29 | | 0.5[c] |
| pH (standard units) | 6.9-8.0 | | 6.6-8.2 | | 6.8-7.6 | |
| Temperature (°C) | 14.5-24.5 | | 14.0-19.0 | | 13.0-15.0 | |
| Conductivity (μmhos/cm) | 260-380 | | 520-1,600 | | 230-250 | |
| TOC | 5-13 | 9 | 5-8 | 6 | 5-7 | 6 |
| Total Solids | 280-946 | 548 | 507-1,090 | 756 | 158-190 | 171 |
| Suspended Solids | 246-608 | 427 | 12-66 | 31 | 12-30 | 20 |
| Suspended Solids (lb/day) | | 1,750 | | 62 | | 83 |
| Oil and Grease | 2-8 | 5 | <1-6) | 2 | | |
| Sulfate | 23-26 | 25 | 212-500 | 289 | 23-26 | 25 |
| Mercury, μg/l | <0.1-0.1 | <0.1 | N.D. | | N.D. | |
| Copper | 0.01-0.08 | 0.04 | <0.01-0.02 | 0.01 | <0.01-0.03 | 0.01 |
| Chromium | N.D.[d] | | <0.01-0.03 | 0.02 | N.D. | |
| Cadmium | N.D. | | N.D. | | N.D. | |
| Lead | 0.1-0.3 | 0.2 | <0.1-0.1 | <0.1 | <0.1-0.1 | <0.01 |

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[a] See Appendix C for Station Description.
[b] All values reported as mg/l, except where otherwise specified.
[c] Data was supplied by the Company.
[d] N.D. - None Detected.

in the air-scrubber discharge. As mentioned previously, no application has been filed for a Refuse Act permit for this discharge.

The EPA interim Effluent Guidelines (dated 21 September 1972) developed for the Cement, Lime, Gypsum, Asbestos, and Flat-Glass industries suggest that the proces-waste stream from a plant of this type should be about 0.135 mgd (27,000 gal/1,000 bbl production). This flow is based upon minimum water use, its time of contact with leachable substances, and upon the elimination of frequent and unnecessary spillage, overflows, and inefficient washing methods. With the best applicable control technology currently available, the suspended solids load would be 35 lb/day (7 lb/1,000 bbl product). The company was discharging suspended solids at a rate (362 lb/1,000 bbl) more than 50 times greater than that stated in the Guidelines.

The guidelines propose that a 24-hr composite sample be taken for COD and suspended solids every two weeks and that the flow be monitored continuously. It shall be considered a violation of the waste-discharge permit if the average analyses over any 20 working days exceed the proposed limitations or if any single composite sample exceeds these limits by more than 50 percent. Four violations in any one single year will require an action memorandum from the Regional Administrator containing recommendations on what action is to be taken. Any single violation of the permit is grounds for revocation. Implementation of the above sampling and monitoring program is considered necessary to ensure adequate pollution control and should be a requirement of the permit issued to this industry.

## D. SUMMARY AND CONCLUSIONS

The Penn-Dixie Cement Corporation discharged a total of 0.78 mgd wastewater to the south Fork of the Holston River through two outfalls. The wastewater contained a daily average load of 1800 lb of suspended solids, or more than 50 times the limit (35 lb/day for a plant of this type) recommended in the EPA interim Effluent Guidelines. Ninety-six percent of this loading came from a supposedly uncontaminated cooling water discharge, for which no permit application had been filed.

To achieve effective pollution control water re-use and conservation must be practiced; the source of suspended solids in the cooling-water stream must be isolated and treated.

## E. RECOMMENDATIONS

It is recommended that:

1. To meet the EPA interim Effluent Guidelines, based on the best practicable control technology currently available, the total COD and suspended solids discharged shall each not exceed 35 lb/day. Additional effluent requirements established by the State of Tennessee shall be met.

2. A schedule and proposed method of treatment for achieving the necessary pollution abatement be provided EPA, Region IV, by 15 October 1973.

# E-VII. TENNESSEE EASTMAN COMPANY
# KINGSPORT, TENNESSEE

## A. GENERAL

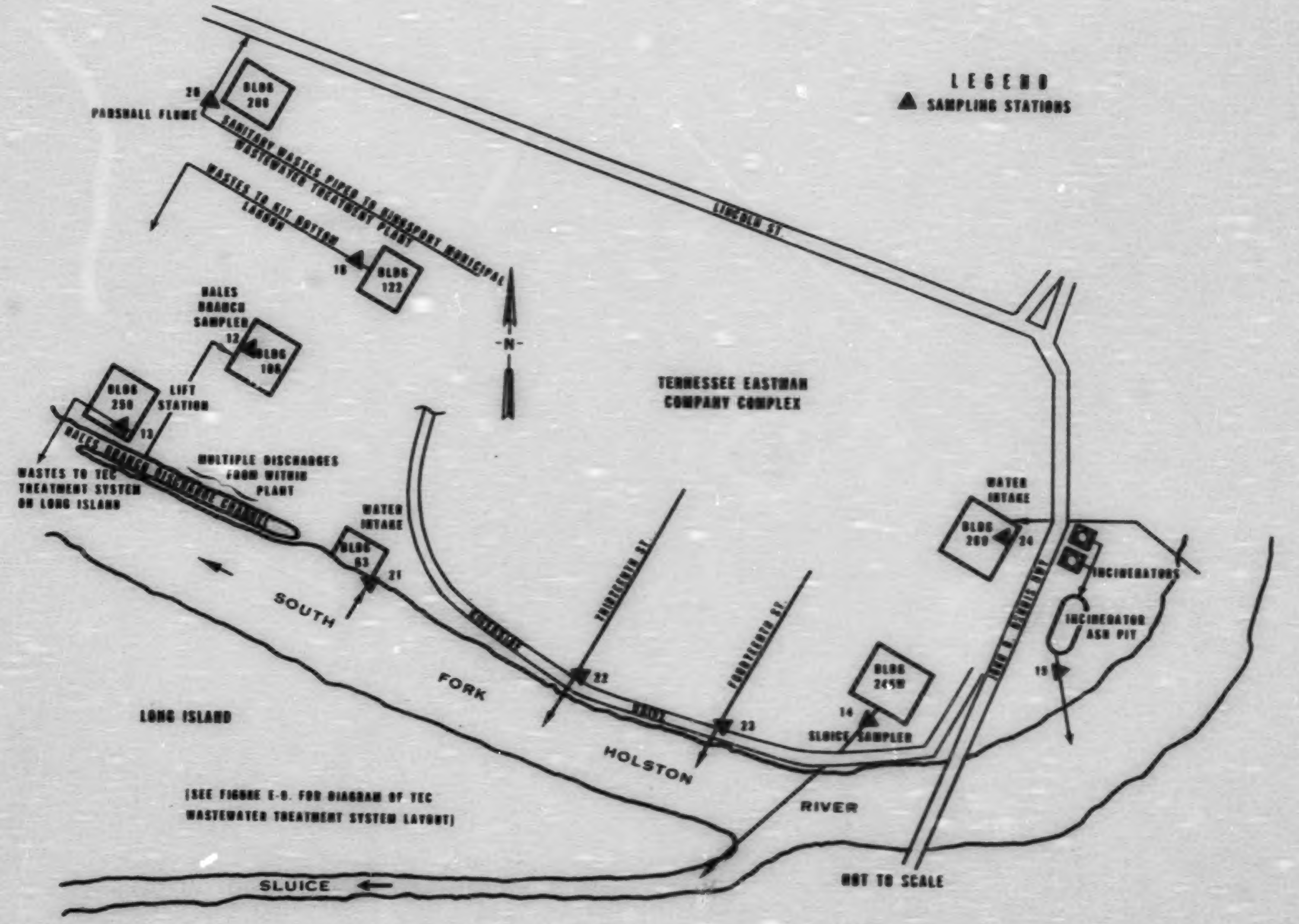
The Tennessee Eastman Company, a division of the Eastman Kodak Company, is one of the largest chemical manufacturers in the United States and makes more than 275 different chemical products (14,500,000 lb/day), falling into three principal categories: plastics, fibers, and chemicals. This firm is one of the principal manufacturers of polyester, acetate and modacrylic fibers, and cellulose plastics in the country and also holds an important position in the production of organic chemicals. Intermediate materials for the Kodak photographic products, fibers, chemicals, and plastics for sale to other manufacturers are produced at this plant.

There are four additional subsidiaries of Eastman Kodak in Kingsport: Eastman Chemical Products, Inc.; Eastman Chemical Inter-American, Ltd.; Bays Mountain Construction Company; and the Holston Defense Corporation, which operates the Holston Army Ammunition Plant for the U. S. Army.

In Kingsport the Tennessee Eastman plant, which operates continuously and employs more than 14,000 people, is located on 415 acres; the property [Figure E-8] includes part of Long Island, formed by a sluice in the South Fork of the Holston River.

In October 1972, J. A. Mitchell, executive vice-president; R. H. Morrison, assistant works manager; J. C. Edwards, manager, Clean Environment Program; and W. V. Walls, Clean Environment Program staff member, supplied EPA and State of Tennessee personnel preliminary information. During the in-plant survey, 4 through 9 December 1972, Messrs. Edwards

E-58a


LEGEND
▲ SAMPLING STATIONS
BLDG 280
28
PARSHALL FLUME
SANITARY WASTES PIPED TO KINGSPORT MUNICIPAL WASTEWATER TREATMENT PLANT
WASTES TO KIT BOTTOM LAGOON
16
BLDG 122
-N-
HALES BRANCH SAMPLER
12
BLDG 106
BLDG 250
LIFT STATION
13
HALES BRANCH DISCHARGE CHANNEL
MULTIPLE DISCHARGES FROM WITHIN PLANT
WASTES TO TEC TREATMENT SYSTEM ON LONG ISLAND
WATER INTAKE
BLDG 63
21
LINCOLN ST
TENNESSEE EASTMAN COMPANY COMPLEX
WATER INTAKE
BLDG 209
24
INCINERATORS
INCINERATOR ASH PIT
15
JOHN B. DENNIS HWY
BLDG 245M
14
SLUICE SAMPLER
22
23
SOUTH
FORK
HOLSTON
RIVER
LONG ISLAND
SLUICE
NOT TO SCALE

(SEE FIGURE E-9. FOR DIAGRAM OF TEC WASTEWATER TREATMENT SYSTEM LAYOUT)

Figure E-8. Sampling Stations – Tennessee Eastman Company
Kingsport, Tennessee

and Walls provided close assistance and cooperation to the EPA personnel.

## B. WASTE SOURCES AND TREATMENT

According to the RAPP[*] application, filed 30 June 1971, the plant withdraws a total of 358 mgd of water from the South Fork of the Holston River at three separate locations and purchases 0.14 mgd from the City of Kingsport. Approximately ten percent of the intake water is treated by coagulation (alum and lime), sedimentation, and filtration. The water is used for cooling purposes (336 mgd), boiler feed (3.7 mgd), process water (16.8 mgd), and for other, miscellaneous purposes (1.1 mgd).

The company recently installed two cooling towers to recycle cooling water and is considering the installation of additional towers in order to reduce the volume of the intake water. Sanitary wastes (0.35 mgd) are discharged to the municipal WWTP, and 1.7 mgd of water is lost through evaporation. Company personnel reported that cooling water and waters from roof and floor drains are discharged directly to the river. Process wastewaters are treated prior to discharge. Waste streams discharged to the river are described in the following sections. [Station numbers refer to sampling locations described in Appendix C. Characteristics of the wastes reported in the RAPP application are listed in Table E-15.]

Except for Station 15, all of the outfalls are equipped with automatic samplers. Samples are collected every few seconds, continually being composited on an equal-volume basis over a 24-hr period, and

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[*] The Federal Water Pollution Control Act Amendments of 1972 stipulate that the Refuse Act permit application be processed through the National Pollutant Discharge Elimination System (NPDES).

## TABLE E-15

## CHARACTERISTICS OF WASTEWATER DISCHARGED TO THE SOUTH FORK OF THE HOLSTON RIVER
TENNESSEE EASTMAN COMPANY, KINGSPORT, TENNESSEE
(REPORTED IN REFUSE ACT PERMIT PROGRAM APPLICATION)

| Station Number | RAPP Serial Number | Flow mgd | BOD | | COD | | SS | | $NH_3$-N | | TKN | | $NO_3$-N | | P | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | mg/l | lb/day | mg/l | lb/day | mg/l | lb/day | mg/l | lb/day | mg/l | lb/day | mg/l | lb/day | mg/l | lb/day |
| 12 | 001 | 297 | 4.5 | 10,200 | 13 | 32,100 | 21 | 51,900 | 1.1 | 2,500 | 0.96 | 2,400 | 0.19 | 470 | 0.02 | 50 |
| 14 | 004 | 7.2 | 23 | 1,500 | 124 | 120[a/] | 19 | 1,100 | 0.79 | 60 | 1.01 | 98 | 0.18 | 10 | 0.04 | 4 |
| 15 | 008 | 0.2 | 7.8 | 13 | 17 | 28 | 24 | 40 | 0.19 | 0.3 | 1.3 | 2.2 | 0.27 | 0.45 | 0.06 | 0.1 |
| 17 | 002 | 9.4 | 141 | 11,600 | 449 | 35,000 | 400 | 31,500 | 99 | 7,800 | 134 | 10,400 | 4.4 | 340 | 6.9 | 540 |
| 19 | 003 | 0.09 | 200 | 156 | 226 | 180 | 38 | 30 | 1.0 | 0.81 | 2.1 | 1.6 | 0.21 | 0.16 | 0.25 | 0.2 |
| 22 | 005 | 4.5 | 6.2 | 200 | 15 | 600 | 31 | 1,200 | 0.27 | 10 | 0.9 | 30 | 0.48 | 20 | 0.10 | 4 |
| 23 | 006 | 9.4 | 1.7 | 130 | 5 | 390 | 8 | 600 | 0.17 | 13 | 0.9 | 70 | 0.56 | 44 | 0.03 | 2 |
| b/ | 007[c/] | 36.3 | 1.8 | 550 | 4.9 | 1,500 | 10 | 3,000 | 0.19 | 57 | 0.97 | 290 | 0.39 | 120 | 0.02 | 6 |
| | TOTAL | 364.1 | | 24,349 | | 69,918 | | 89,370 | | 10,441 | | 13,292 | | 1,004 | | 606 |

| Station Number | RAPP Serial Number | Cu | | Mn | | Ni | | Cn | | Zn | | Oil & Grease | | Phenols | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | mg/l | lb/day | mg/l | lb/day | mg/l | lb/day | mg/l | lb/day | mg/l | lb/day | mg/l | lb/day | mg/l | lb/day |
| 12 | 001 | | | 95 | 230[a/] | | | | | 83 | 200 | 3.0 | 7,400 | 22 | 54 |
| 14 | 004 | | | | | | | | | 23 | 1 | 2.9 | 170 | 12 | 1 |
| 15 | 008 | | | | | | | | | | | 12 | 20 | | |
| 17 | 002 | 80 | 6 | 57 | 4,400 | 6 | 5 | | | 93 | 7 | 5.6 | 440 | 28 | 2 |
| 19 | 003 | | | 5 | 4 | | | | | | | 3.7 | 3 | | |
| 22 | 005 | | | | | | | 222 | 8 | 27 | 1 | 3.9 | 150 | | |
| 23 | 006 | | | | | | | | | 27 | 2 | 3.4 | 270 | 9 | 1 |
| b/ | 007[c/] | | | | | | | | | 20 | 6 | 4.1 | 1,200 | 4 | 1 |
| | TOTAL | | 6 | | 4,634 | | 5 | | 8 | | 217 | | 9,653 | | 59 |

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[a/] Values appear to have been miscalculated by Company officials.
[b/] This station was not sampled.
[c/] Discharge No. 007 reported in RAPP application now contains storm water and groundwater infiltration.

analyzed in the Tennessee Eastman laboratory. The company sends analytical results of the intake water, sluice discharge (Station 14), Hales Branch (Station 12) and the aerated lagoon discharge (Station 17) to the State of Tennessee Stream Pollutaion Control Division.

### Station 12

A small stream, Hales Branch, enters the plant grounds and has a flow of approximately 1 mgd. Cooling water from the entire plant, sludges from the water treatment plant, and some process water (reportedly low in BOD) are discharged to the stream, all of which increases the flow to 350 mgd. The rate of flow is continuously recorded, and a composited sample is collected as the discharges pass over a weir into the South Fork of the Holston River (RM 142.15/4.5).

### Station 14

Wastewater from storm and floor drains located in the south-plant area and a small amount of the water from the cooling towers is pumped through two 36-in. lines under the South Fork of the Holston River and discharges into the sluice (RM 142.15/5.5/4.3).

### Station 15

Two rotary kiln incinerators and one coal-fired incinerator are used to burn 130,000 lb/day of waste chemicals, sludges, and solid wastes. A continuous flow of cooling water from the incinerators, joined by an intermittent flow of water used to wash ashes out of the incinerator, discharges to a ditch that flows to a small lagoon. The lagoon discharges through a submerged, 12-in. pipe to the South Fork of the Holston River (RM 142.15/5.8).

## Station 17

Process wastes have been separated into two waste streams, one containing high levels of suspended solids and one containing mostly dissolved contaminants. Both waste streams are acidic.

The waste stream with a high concentration of suspended solids is neutralized with limestone and pumped to a quiescent lagoon designated Kit Bottom (28 acres, 120-day detention time). Solids are not removed from the lagoon, and the company estimates that Kit Bottom has storage capacity for another five years. When the lagoon becomes filled, another site will be selected. The company stated that there have been no direct discharges to the river in three years. The overflow is pumped to the aerated lagoons described herein [Figure E-9].

The waste stream with the dissolved contaminants is neutralized with lime and pumped from the lift station in Building 250 to two aerated lagoons (having a total area of 20 acres, 5-day detention time, operated in series) on Long Island equipped with forty-five 75-hp aerators. Every five minutes a continuously recording Total Carbon Analyzer samples the effluent stream from the Building 250 lift station. If the total carbon concentration in six consecutive samples exceeds 800 mg/1, 80 percent of the flow is sent to the diversion basin. Later, the flow is pumped to the aerated lagoons at a controlled rate in order to minimize the effect of shock loads. Process wastes generated on Long Island are pumped by the Long Island lift station to the aerated lagoons.

The effluent from the second aerated lagoon discharges intermittently to the South Fork of the Holston River (RM 142.15/3.5). An

E-62a

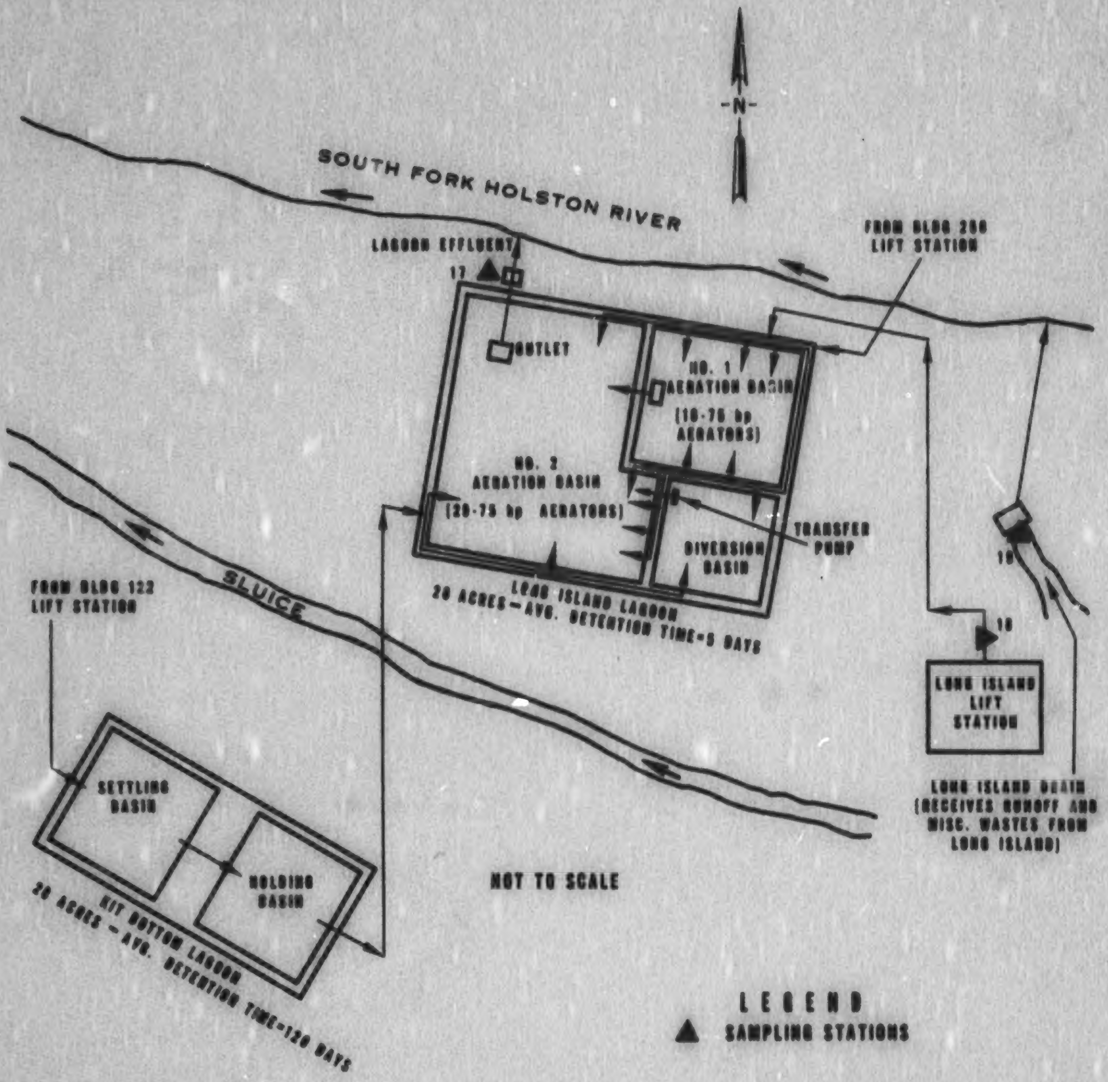
-N-
SOUTH FORK HOLSTON RIVER
LAGOON EFFLUENT
17
FROM BLDG 250 LIFT STATION
OUTLET
NO. 1 AERATION BASIN (10-75 hp AERATORS)
NO. 2 AERATION BASIN (20-75 hp AERATORS)
TRANSFER PUMP
DIVERSION BASIN
LONG ISLAND LAGOON
20 ACRES—AVG. DETENTION TIME-5 DAYS
19
18
LONG ISLAND LIFT STATION
LONG ISLAND BASIN (RECEIVES RUNOFF AND MISC. WASTES FROM LONG ISLAND)
SLUICE
FROM BLDG 122 LIFT STATION
SETTLING BASIN
HOLDING BASIN
KIT BOTTOM LAGOON
20 ACRES — AVG. DETENTION TIME-120 DAYS
NOT TO SCALE
LEGEND
▲ SAMPLING STATIONS

Figure E-9. Wastewater Treatment System Layout (Long Island and Kit Bottom)
Tennessee Eastman Company
Kingsport, Tennessee

electronically operated valve, activated when the lagoon reaches a pre-set level, allows the effluent to discharge to a wet well and then to the river.

## Station 19

Surface runoff from Long Island and the overflow from the Long Island lift station are discharged to the South Fork of the Holston River (RM 142.15/4.5) via a ditch designated the Long Island Drain. The flow is intermittent.

## Station 22

The discharge from the 13th Street sewer outfall consists of storm water, cooling water, floor and roof drainage, and some storm runoff from the Lincoln Street area of the City of Kingsport. Solids, collected by air pollution equipment, are periodically flushed through the outfall. The flow is discharged to the South Fork of the Holston River (RM 142.15/5.2) through a 54-in. pipe.

## Station 23

The 14th Street sewer, containing storm water, cooling water, and floor and roof drainage, discharges to the South Fork of the Holston River (RM 142.15/5.3) through a 60-in. pipe.

Currently, the company is completing the construction of a pilot treatment facility to reduce the BOD discharged from the aerated lagoons on Long Island (Station 17). Plans call for: the use of the aerated lagoon as part of an activated sludge facility; a final clarifier to follow the aerated lagoons, with a portion of the solids to be returned to the clarifier; and the excess solids to be aerobically digested. The pilot plant is scheduled for start-up early in 1973 and is to be operated for one year with engineering for the full-scale plant proceeding concurrently.

## C. PLANT EVALUATION AND FINDINGS

Samples were collected over a 24-hr period for each of five days with automatic samplers at all locations; the exception was Station 16 (influent to Kit Bottom lagoon) where grab samples were collected manually every two hr for a 24-hr period. All samples were composited on an equal-volume basis. Three grab samples each for phenolic materials and oil and grease were collected every two hr and composited over a four-to-six hr period. Temperature, pH, and conductivity were measured at least three times each day. Flows were obtained from existing company flow recorders at Stations 12, 13, 14, 16, 18, 20, 21, and 24. NFIC-D personnel measured the flows at Stations 15, 19, 22, and 23.

### Discharges to the River

There are three sources of intake water, Buildings 63, 269, and 28. Samples were collected upstream of the Tennessee Eastman Company outfalls (Building 269, Station 24), and downstream from several company outfalls (Building 63, Station 21) [Table E-16]. The BOD levels were 1.1 mg/1 and 1.6 mg/1, respectively; the suspended-solids concentrations were 14 mg/1 and 19 mg/1, respectively; and the nitrate-nitrite-nitrogen concentrations were 1.0 mg/1 and 1.9 mg/1, respectively. The concentrations of other

# TABLE E-16

## SUMMARY OF FIELD MEASUREMENTS AND CHEMICAL DATA
## TENNESSEE EASTMAN COMPANY
## KINGSPORT, TENNESSEE
## 4-9 DECEMBER 1972

| Station Number | 21 | | 24 | |
|---|---|---|---|---|
| Station Description[a] | Intake 63<br>(RM 142.15/4.80) | | Intake 269<br>(RM 142.15/5.70) | |
| Parameter[b] | Range | Average | Range | Average |
| Flow (mgd) | 312.5-321.9 | 316.8 | 49.5-51.0 | 50.1 |
| pH (standard units) | 6.6-7.6 | | 6.6-7.6 | |
| Temperature (°C) | 10.0-12.5 | | 9.0-13.0 | |
| Conductivity (µmhos/cm) | 220-270 | | 200-260 | |
| BOD | 0.5-2.6 | 1.6 | 0.5-1.6 | 1.1 |
| BOD (lb/day) | | 4,220 | | 452 |
| TOC | 1-9 | 4 | 1.0-5.0 | 3.0 |
| Total Solids | 99-186 | 129 | 81-221 | 127 |
| Suspended Solids | 2-48 | 19 | 6-26 | 14 |
| Suspended Solids (lb/day) | | 48,800 | | 6,050 |
| Total Kjeldahl Nitrogen-N | <0.5-0.8 | <0.5 | N.D.[c] | |
| $NH_3$-N | <0.5 | <0.5 | N.D. | |
| $NO_2 + NO_3$-N | 0.9-6.0 | 1.9 | 0.9-1.1 | 1.0 |
| $NO_2 + NO_3$-N (lb/day) | | 5,100 | | 396 |
| Total Phosphorus-P | 0.03-0.06 | 0.05 | 0.03-0.04 | 0.04 |
| Total Phosphorus-P (lb/day) | | 137 | | 15.6 |
| Mercury, µg/l | <0.1-0.1 | <0.1 | <0.1-0.2 | <0.1 |
| Copper | 0.01-0.03 | 0.02 | <0.01-0.02 | 0.01 |
| Chromium | <0.01-0.02 | <0.01 | <0.01-0.02 | <0.01 |
| Manganese | 0.03-0.06 | 0.04 | 0.02-0.03 | 0.03 |
| Cadmium | N.D. | | N.D. | |
| Nickel | N.D. | | N.D. | |
| Zinc | 0.03-0.05 | 0.03 | 0.04-0.05 | |
| Lead | <0.1-0.1 | <0.1 | N.D. | |

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a/ See Appendix C for Station Description.

b/ All values reported as mg/l, except where otherwise specified.

c/ N.D. - None Detected.

constituents were not significant. Effluent guidelines for this industry for discharges to receiving streams are being developed on the gross loads. Therefore, the data reported herein has not been adjusted to reflect net loads. [Chemical data and field measurements are summarized in Table E-17.]

A waste-source evaluation and stream survey conducted in July 1969 revealed that waste discharges in the Kingsport area degraded the water quality of the South Fork of the Holston River and the Holston River. At the time of the survey the Tennessee Eastman Company was discharging approximately 69,300 lb of BOD; 16,100 lb of total Kjeldahl-nitrogen; 10,800 lb of $NH_3$-N, 1,800 lb of total P, and 7,800 lb of suspended solids daily to the South Fork. The BOD and TKN discharged comprised about 50 and 83 percent, respectively, of the total BOD and TKN loads discharged from the waste sources evaluated. The 1969 report concluded that in order to maintain a minimum concentration of 3.0 mg/l DO in the Holston River, the total pollution loads discharged within the Kingsport area should be limited to a maximum of 14,040 lb BOD/day and 1,940 lb TKN/day, to prevent further degradation of the receiving waters. The limits are equivalent to a 92-percent reduction of BOD and TKN. It was also concluded that the total Kjeldahl-nitrogen must be removed and not converted to nitrates before discharge as the aquatic weed population would still increase from assimilation of the nitrates. In addition, it was found that the temperature of the South Fork of the Holston River was increased by more than 11.0°C by heated discharges from TEC and HAAP "A". It was concluded that cooling devices would be necessary to preclude violations of the stream-temperature standards for fish and aquatic life [Appendix A-Item 3(g)].

TABLE E-17

SUMMARY OF FIELD MEASUREMENTS AND CHEMICAL DATA
DISCHARGES TO SOUTH FORK HOLSTON RIVER
TENNESSEE EASTMAN COMPANY-KINGSPORT, TENNESSEE
4-9 DECEMBER 1972

| Station Number | 12 | | 14 | | 15 | | 17 | |
|---|---|---|---|---|---|---|---|---|
| Station Description[a] | Hales Branch (RM 142.15/4.50) | | Sluice Outfall (RM 142.15/4.50) | | Incinerator Ash Scrubber (RM 142.15/5.60) | | Aerated Lagoon Effluent (RM 142.15/3.50) | |
| Parameter[b] | Range | Average | Range | Average | Range | Average | Range | Average |
| Flow (mgd) | 306-317 | 311 | 5.8[c] | 5.8 | 0.289-0.384 | 0.325 | 9.98-10.9 | 10.4 |
| pH (standard units) | 6.3-7.5 | | 6.7-7.9 | | 7.2-8.6 | | 6.7-7.3 | |
| Temperature (°C) | 22.5-25.0 | | 17.0-23.5 | | 16.0-21.5 | | 13.5-19.0 | |
| Conductivity (µmhos/cm) | 240-340 | | 200-260 | | 200-280 | | 1,400-4,000 | |
| BOD | 3.2->9.1 | >5.6 | 5.9-23 | >11.0 | 7.5-15 | >9.6 | 280-620 | >400 |
| BOD (lb/day) | | >14,000 | | >526 | | >26 | | >35,100 |
| COD | | | | | | | 869-985 | 941 |
| TOC | 2.0-5.0 | 4.0 | 2.0-11.0 | 6.0 | 4.0-34.0 | 12.0 | 238-300 | 272 |
| Total Solids | 83-172 | 136 | 67-201 | 154 | 82-374 | 197 | 3,340-3,640 | 3,480 |
| Suspended Solids | 4-31 | 12 | 6-14 | 10 | 4-26 | 12 | 410-820 | 648 |
| Suspended Solids (lb/day) | | 30,800 | | 484 | | 33 | | 56,100 |
| Total Kjeldahl Nitrogen-N | <0.5-0.5 | <0.5 | <0.5-0.5 | <0.5 | N.D.[d] | | 89-140 | 120 |
| Total Kjeldahl Nitrogen-N (lb/day) | | | | | | | | 10,400 |
| $NH_3$-N | N.D. | | N.D. | | N.D. | | 90-100 | 93 |
| $NH_3$-N (lb/day) | | | | | | | | 8,130 |
| $NO_2 + NO_3$-N | 0.7-0.9 | 0.8 | 0.8-1.0 | 0.9 | 0.6-0.7 | 0.6 | 0.1[c] | 0.1 |
| $NO_2 + NO_3$-N (lb/day) | | 2,070 | | 43 | | | | |
| Total Phosphorus-P | 0.03-0.05 | 0.04 | 0.02-0.06 | 0.04 | 0.06-0.26 | 0.11 | 5.8-13 | 9.8 |
| Total Phosphorus-P (lb/day) | | 109 | | | | | | 840 |
| Oil and Grease | <1-3 | <1 | | | 1-10 | 6 | 2-10 | 6 |
| Phenols | N.D. | | | | | | 0.6-1.1 | 0.8 |
| Mercury, µg/l | <0.1-0.2 | 0.1 | <0.1-0.1 | <0.1 | | | 0.1-0.3 | 0.2 |
| Copper | 0.02-0.03 | 0.03 | 0.02-0.04 | 0.03 | | | 0.10-0.21 | 0.13 |
| Chromium | N.D. | | N.D. | | | | 0.31-0.40 | 0.36 |
| Iron | 0.5-0.9 | 0.7 | | | | | | |
| Manganese | 0.15-0.29 | 0.22 | 0.02-0.04 | 0.03 | | | 100-108 | 103 |
| Cadmium | N.D. | | N.D. | | | | N.D. | |
| Nickel | N.D. | | N.D. | | | | 0.1-0.2 | 0.2 |
| Zinc | 0.06-0.07 | 0.06 | 0.04-0.06 | 0.05 | | | 5.1-6.5 | 5.8 |
| Lead | N.D. | | N.D. | | | | <0.1-0.2 | 0.1 |

## TABLE E-17 (Cont.)

## SUMMARY OF FIELD MEASUREMENTS AND CHEMICAL DATA
## DISCHARGES TO SOUTH FORK HOLSTON RIVER
## TENNESSEE EASTMAN COMPANY-KINGSPORT, TENNESSEE
## 4-9 DECEMBER 1972

| Station Number | 19 | | 22 | | 23 | |
|---|---|---|---|---|---|---|
| Station Description[a/] | Storm Drainage Overflow (RM 142.15/4.50) | | 13th St. Sewer (RM 142.15/5.20) | | 14th St. Sewer (RM 142.15/5.30) | |
| Parameter[b/] | Range | Average | Range | Average | Range | Average |
| Flow (mgd) | 0.101-0.174 | 0.136 | 4.1-4.6 | 4.3 | 10.3-11.5 | 10.8 |
| pH (standard units) | 6.0-7.3 | | 6.5-9.0 | | 6.7-8.1 | |
| Temperature (°C) | 11.0-26.5 | | 15.5-24.0 | | 18.0-23.5 | |
| Conductivity (umhos/cm) | 400-950 | | 246-300 | | 229-340 | |
| BOD | 42-600 | 200 | 14-37 | >26 | 4.9-29 | >14 |
| BOD (lb/day) | | 230 | | >939 | | >1,250 |
| COD | 60-1,480 | 452 | 42-83 | 59 | 53[e/] | |
| TOC | 12-200 | 54 | 8-19 | 12 | 3.0-11.0 | 6.8 |
| Total Solids | 674-833 | 764 | 392-1,020 | 621 | 103-210 | 134 |
| Suspended Solids | 44-143 | 100 | 172-632 | 471 | 6-25 | 15 |
| Suspended Solids (lb/day) | | 113 | | 16,700 | | 1,330 |
| Total Kjeldahl Nitrogen-N | 1.3-3.6 | 2.5 | <0.5-2.3 | <1.1 | <0.5-1.2 | 0.8 |
| Total Kjeldahl Nitrogen-N (lb/day) | | | | 31 | | 33 |
| $NH_3$-N | 1.5-2.7 | 2.0 | <0.5-0.5 | <0.5 | N.D. | |
| $NH_3$-N (lb/day) | | | | 11 | | |
| $NO_2$ + $NO_3$-N | 0.1-0.4 | 0.3 | 0.7-0.8 | 0.8 | 0.9-1.0 | 1.0 |
| $NO_2$ + $NO_3$-N (lb/day) | | | | 28 | | 88 |
| Total Phosphorus-P | 0.32-1.3 | 0.67 | 0.27-1.6 | 0.91 | 0.01-0.09 | 0.05 |
| Total Phosphorus-P (lb/day) | | | | 32 | | |
| Oil and Grease | 3-46 | 19 | | | | |
| Phenols | <0.01-0.04 | 0.03 | | | | |
| Mercury, ug/l | | | <0.1-0.4 | 0.1 | N.D. | |
| Copper | | | 0.02-0.05 | 0.04 | 0.03-0.04 | 0.03 |
| Chromium | | | <0.01-0.05 | 0.01 | <0.01-0.02 | <0.01 |
| Manganese | | | 0.07-0.12 | 0.08 | 0.03-0.05 | 0.04 |
| Cadmium | | | N.D. | | N.D. | |
| Nickel | | | N.D. | | N.D. | |
| Zinc | | | 0.07-0.14 | 0.09 | 0.05-0.07 | |
| Lead | | | <0.1-0.1 | <0.1 | N.D. | |

a/ See Appendix C for Station Description.
b/ All values reported as mg/l, except where specified.
c/ All values are the same.
d/ N.D. - None Detected.
e/ This is based on one value.

During the 1972 EPA survey the combined flow from the seven outfalls was approximately 343 mgd. The BOD discharged was more than 52,000 lb/day. This load is less than the load discharged in 1969, but much greater than the 28,800 lb/day reported in the RAPP application. The waste streams at Stations 12 (Hales Branch) and 17 (Long Island lagoons) contributed more than 14,000 lb/day and 35,000 lb/day of BOD, respectively.

The total Kjeldahl-nitrogen discharged averaged 10,400 lb/day, a decrease of 5,700 lb from the 1969 survey. The nitrite-nitrate nitrogen discharge averaged 2,180 lb/day, but the concentrations were equivalent to concentrations in the raw intake water.

The State of Tennessee has verbally requested that the Company not discharge more than 17,500 lb BOD/day. However, to maintain a minimum concentration of 5.0 mg/l DO, the official standard, in the Holston River and to protect the water quality of the receiving waters, the recommended waste load limits, are 3,350 lb BOD/day and 400 lb TKN/day. To meet these recommended limits, the cooling waters and process waste streams must be separated completely.

The suspended solids load discharged increased from the 1969 value (7,800 lb/day) to 106,000 lb/day (the RAPP application reported 86,400 lb/day). Waste flows at Stations 12 and 17 contributed 30,800 lb/day and 56,100 lb/day, respectively. The suspended solids discharged from Station 22 (13th Street sewer) averaged 16,700 lb/day. The RAPP application reported that 600 lb/day were discharged from this location; the increase in solids might be attributable to the solids that are flushed to the outfall from the air pollution equipment. Approximately 950 lb/day of phosphorus were discharged; 840 lb/day were contributed by the waste stream at Station 17.

Several heavy metals are used at the plant as catalysts including manganese (preparation of hydroquinone). The highest concentration of a heavy metal found was manganese, 103 mg/l at Station 17 (8,990 lb/day). More than 500 lb/day of zinc were also discharged from this outfall. Although present in low concentrations, significant amounts of iron (1,800 lb), manganese (564 lb), and zinc (163 lb) were discharged daily from Hales Branch (Station 12). Sediments downstream from these outfalls [Section VII Stream Survey] had concentrations as high as 22,725 mg/kg for iron and 2,080 mg/kg for manganese.

Wastewater from Station 14 (outfall to the sluice) contributed 0.22 mg/l of diphenyl ether [Table E-18]. The effluent from the lagoons (Station 17) contained a complex mixture of at least 40 organic compounds. Among the compounds detected were alkylated phenols, alkylated and chlorinated aniline derivitives, aliphatic hydrocarbons, alkylated benzenes, and phthalic acid esters. Trichlorobenzene (0.75 mg/l) and trichloroaniline (0.08 mg/l) were identified, both of which are known to be toxic to aquatic life, especially from continuous exposure. Chlorohexadecane and chloroheptadecane, di-1-2-ethylhexyadipate, di-n-octylphthlate, and 4,4-dimethyl-1-pentene were also present. The continued discharge of these compounds could cause localized degradation of the South Fork of the Holston River.

Static bioassay studies were run on five waste effluents from TEC (Stations 12, 14, 17, 22 and 23). The waste from Stations 12, 14, 22,

## TABLE E-18

## ORGANIC POLLUTANTS IDENTIFIED
## TENNESSEE EASTMAN COMPANY
## KINGSPORT, TENNESSEE

| Compound | Concentration (mg/l) | Load (lb/day) |
|---|---|---|
| Station 14 | | |
| 1,4-dimethylcyclohexane | * | |
| diphenyl ether | 0.22 | 11 |
| Station 17 | | |
| 4,4-dimethyl-1-pentene | 0.06* | 5.2 |
| trichlorobenzene | 0.75 | 65 |
| trichloroaniline | 0.08* | 6.9 |
| bis-(2-ethylhexyl)fumarate | * | |
| prob. $C_{16}$ (chlorohexadecane) | 0.50* | 43 |
| prob. $C_{17}$ (chloroheptadecane) | 0.25* | 22 |
| di-(-2-ethylhexyl)adipate | 0.08 | 6.9 |
| di-*n*-octylphthalate | 1.83 | 158 |
| Several subs. alkanes & aromatics | .05 to .50* | 4.3 to 43 |
| Station 20 | | |
| *m*- & *p*-xylene | 0.08 | .20 |
| ethoxyethyl acetate | 0.70 | 1.7 |
| 2-ethyl-1-hexanol | 0.13 | .32 |
| *m*-chloroaniline | 0.025 | .06 |
| *n*-tricosane | 0.025 | .06 |
| *n*-tetracosane | 0.05 | .12 |
| *n*-pentacosane | 0.12 | .30 |
| *n*-heptacosane | 0.25 | .62 |
| *n*-octacosane | 0.25 | .62 |
| *n*-nonacosane | 0.25 | .62 |
| *n*-triacontane | 0.20 | .49 |
| *n*-hentriacontane | 0.15 | .37 |
| *n*-dotriacontane | 0.12 | .30 |
| *n*-tritriacontane | 0.12 | .30 |
| *n*-tetratriacontane | 0.05 | .12 |
| 2,5-dimethyltetradecane | * | |
| methyl indole | * | |
| *n*-hexacosane | 0.18 | .44 |

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* Estimated-Standard not available for confirmation.

and 23 were not toxic to fathead minnows in 100-percent concentrations for 96 hours. However, the studies showed that wastewaters from Station 17 were toxic to fish. The 96-hr $TL_m$ derived from the static bioassays with fathead minnows was 64 percent. Other static bioassays using bluegills showed the 96-hr $TL_m$ to be a waste concentration of 36 percent. Based upon 1/20 of the 96-hr $TL_m$ it was calculated that toxic wastewater from Station 17 would have to be diluted by maintaining approximately 800 cfs in the South Fork of the Holston River in order to protect aquatic life.

## Waste-Treatment Facility

The performance of the Long Island treatment system was evaluated. The effluent from the Kit Bottom lagoon is pumped to the aerated lagoons. Therefore, Kit Bottom was considered as part of the treatment facility. [Wastewater characteristics of the three influents, Stations 13, 16, and 18, are summarized in Table E-19, characteristics of the effluent, Station 17, in Table E-17.]

The combined influent flow was 10.4 mgd, with the influent at Station 13 (Lift Station in Building 250) contributing 9.9 mgd. The total influent BOD and suspended-solids loads were greater than 76,500 lb/day and 50,600 lb/day, respectively. The daily effluent load discharged to the South Fork of the Holston River contained more than 35,100 lb of BOD and 56,100 lb of suspended solids. The treatment efficiencies of the facility were as follows:

## TABLE E-19

### SUMMARY OF FIELD MEASUREMENTS AND CHEMICAL DATA
### INFLUENT TO INDUSTRIAL WASTEWATER TREATMENT FACILITY
### TENNESSEE EASTMAN COMPANY-KINGSPORT, TENNESSEE
### 4-9 DECEMBER 1972

| Station Number | 13 | | 16 | | 18 | |
|---|---|---|---|---|---|---|
| Station Description[a] | 250 Lift Station Effluent (RM 142.15/4.50) | | Influent, Kit Bottom Lagoon (RM 142.15/4.60) | | Long Island Lift Station (RM 142.15/3.70) | |
| Parameter[b] | Range | Average | Range | Average | Range | Average |
| Flow (mgd) | 9.59-10.4 | 9.93 | 0.169-0.394 | 0.282 | 0.219-0.239 | 0.227 |
| pH (standard units) | 2.4-9.9 | | 1.3-6.6 | | 4.2-9.5 | |
| Temperature (°C) | 32.0-38.0 | | 18.0-28.0 | | 21.5-42.0 | |
| Conductivity (umhos/cm) | 2,000-4,500 | | 4,300-60,000 | | 260-800 | |
| BOD | >38->810 | >492 | >6,000-18,000 | >10,000 | 1,100-1,700 | 1,400 |
| BOD (lb/day) | | >50,600 | | >25,900 | | 2,620 |
| COD | 1,850-2,040 | 1,920 | 21,300-38,600 | 29,500 | 1,070-3,290 | 1,830 |
| TOC | 340-440 | 391 | 5,800-9,100 | 7,200 | 130-580 | 325 |
| Total Solids | 2,320-2,480 | 2,410 | 25,400-47,500 | 35,500 | 384-1,090 | 689 |
| Suspended Solids | 89-248 | 159 | 8,820-25,800 | 15,400 | 28-298 | 98 |
| Suspended Solids (lb/day) | | 13,300 | | 37,200 | | 183 |
| Total Kjeldahl Nitrogen-N | 100-140 | 120 | 230-500 | 382 | 2.6-30 | 8.4 |
| Total Kjeldahl Nitrogen-N (lb/day) | | 10,100 | | 904 | | 15.8 |
| $NH_3$-N | 96-110 | 104 | 33-600 | 341 | 1.2-10 | 3.3 |
| $NH_3$-N (lb/day) | | 8,660 | | 763 | | 6.25 |
| $NO_2$ + $NO_3$-N | 0.7-1.7 | 1.0 | 1.4-36 | 12.7 | 0.2-1.2 | 0.8 |
| $NO_2$ + $NO_3$-N (lb/day) | | 84.1 | | 34 | | |
| Total Phosphorus-P | 7.7-33 | 19 | 6.4-51 | 25 | 2.3-15 | 7.5 |
| Total Phosphorus-P (lb/day) | | 1,570 | | 65.5 | | 14.3 |
| Manganese | 4.3-5.6 | 4.8 | 760-2,200 | 1,290 | 1.31-7.2 | 3.0 |

---

[a] See Appendix C for Station Description.

[b] All values reported as mg/l, except where otherwise specified.

| Parameter | % Removal |
|---|---|
| BOD | 54 |
| COD | 65 |
| SS | 10 (increase) |
| $NH_3$-N | 14 |
| Total P | 49 |

The aerated lagoon effluent had an average manganese concentration of 103 mg/l. The major in-put into the aerated lagoons is from Kit Bottom which had an influent manganese concentration averaging 1,290 mg/l (the Kit Bottom effluent was not analysed). The high manganese concentration present in the aerated lagoon system may have inhibitory effects on biological treatment. The lagoons were not achieving adequate treatment during the survey.

## Wastes Discharged to the Municipal Sewer

Wastewater discharged (Station 20) to the Kingsport WWTP had average BOD and suspended solids levels of 400 mg/l each [Table E-20]. In addition, eight long-chain alkanes were detected, ranging in concentrations from 0.05 to 0.25 mg/l [Table E-18]. Also identified were *m*-chloroaniline, 2-ethyl-1-hexanol, *m*- and *p*-xylene, and ethoxyethyl acetate. These organic chemicals could be toxic to biological treatment systems at the wastewater treatment plant or pass through the plant untreated.

## D. SUMMARY AND CONCLUSIONS

The Tennessee Eastman Company discharged 343 mgd of cooling water and process wastewater to the South Fork of the Holston River. The total loads of BOD and total Kjeldahl-nitrogen exceeded 52,000 lb/day and 10,400 lb/day, respectively. The suspended-solids load averaged

## TABLE E-20

## SUMMARY OF FIELD MEASUREMENTS AND CHEMICAL DATA
## TENNESSEE EASTMAN COMPANY
## SANITARY WASTES

| Station Number | 20 | |
|---|---|---|
| Station Description[a] | Sanitary Wastes | |
| Parameter[b] | Range | Average |
| Flow (mgd) | 0.181-0.407 | 0.295 |
| pH (standard units) | 2.7-8.4 | |
| Temperature (°C) | 18.0-22.5 | |
| Conductivity (µmhos/cm) | 320-1,500 | |
| BOD | 290-560 | 403 |
| BOD (lb/day) | | 1,100 |
| COD | 214-1,750 | 735 |
| TOC | 58-184 | 103 |
| Total Solids | 401-4,960 | 1,740 |
| Suspended Solids | 70-968 | 401 |
| Suspended Solids (lb/day) | | 857 |
| Total Kjeldahl Nitrogen-N | 22-30 | 27 |
| Total Kjeldahl Nitrogen-N (lb/day) | | 70 |
| $NH_3$-N | 13-24 | 17 |
| $NH_3$-N (lb/day) | | 46 |
| $NO_2$ + $NO_3$-N | 0.3-2.3 | 0.9 |
| Total Phosphorus-P | 4.2-5.9 | 4.8 |
| Total Phosphorus-P (lb/day) | | 12.5 |
| Oil and Grease | 5.5-39 | 21 |
| Phenols | 1.0-15 | 7.5 |
| Mercury, µg/l | 0.5-2.7 | 1.4 |
| Copper | 0.01-0.09 | 0.05 |
| Chromium | 0.04-0.09 | 0.07 |
| Manganese | 0.27-0.37 | 0.32 |
| Cadmium | N.D.[c] | |
| Nickel | N.D. | |
| Zinc | 0.24-0.43 | 0.33 |
| Lead | 0.2-0.3 | 0.3 |

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[a] See Appendix C for Station Description.

[b] All values reported as mg/l, except where otherwise specified.

[c] N.D. - None Detected.

106,000 lb/day during the five-day survey. Flows from Hales Branch (Station 12) and the Long Island lagoons (Station 17) contributed more than 49,000 lb BOD/day while the lagoon effluent contained 100 percent of the total Kjeldahl-nitrogen discharged. The State of Tennessee has concluded that in order to protect water-quality standards for a minimum DO concentration of 5.0 mg/l in the Holston River, the raw waste loads from TEC must be reduced to not more than 3,350 lb BOD/day and 400 lb TKN/day. If a minimum DO concentration of 3.0 mg/l is to be maintained, the loads of BOD and total Kjeldhal-nitrogen in the effluent must not exceed 6,000 lb/day and 1,600 lb/day, respectively.

A number of organic pollutants were identified in the TEC discharges. The impact of these pollutants on aquatic life, through chronic exposure, is presently unknown. However, compounds such as trichlorobenzene and trichloraniline (both measured in the Long Island lagoon effluent) are known to be quite toxic and undoubtedly contribute to the toxicity of this discharge.

Static bioassay studies showed that wastewaters from the Long Island lagoons were toxic to fish. The 96-hr $TL_m$ derived from the static bioassays with fathead minnows was with a 64 percent waste concentration. Other static bioassays using bluegills showed the 96-hr $TL_m$ at a waste concentration of 36 percent. Based upon 1/20 of the 96-hr $TL_m$ it was calculated that toxic concentrations in the wastewater from the Long Island lagoons would have to be reduced by 95-percent to protect aquatic life in the South Fork of the Holston River. The discharge of toxic substances constitutes a violation of the Water Quality Standards for fish and aquatic life [Appendix A, Item 3(g)--Toxic Substances].

Analyses of heavy metals disclosed that 9,500 lb of manganese and 660 lb of zinc were discharged daily, the majority of which was contained in the Long Island lagoon effluent. The manganese load caused a violation of the Tennessee Water Quality Standards occurring at Church Hill Bridge (Station 56).

## E. RECOMMENDATIONS

It is recommended that:

1. To maintain a minimum concentration of 5.0 mg/l DO in the Holston River, all process wastewater shall be immediately segregated from the once-through, non-contact cooling water. The total BOD and TKN discharged in the process wastewaters shall not exceed 3,350 lb and 400 lb/day, respectively. These loads are based on requirements necessary to maintain a minimum concentration of 5.0 mg/l DO in the Holston River. The suspended solids in the process wastewater shall not exceed 30 mg/l over background levels. The total heavy-metals content shall not exceed 1.0 mg/l and the nitrite + nitrate-nitrogen shall not exceed 1.0 mg/l with a pH within the range of 6.0 to 9.0 at all times. There shall be no detectable discharge of potentially toxic organic wastes.

A suggested treatment system to meet these effluent limitations could incorporate:

a) Pretreatment measures to protect biological treatment process

b) Activated sludge

c) Deep-bed filtration

d) Carbon adsorption

e) Dentrification

2. Pretreatment regulations shall be established for the waste discharged to the Kingsport WWTP requiring the removal of potentially toxic organic substances and other pollutants to levels that will not inhibit biological treatment processes or pass through the systems in concentrations or loads inconsistent with effluent limitations which will be established pursuant to the Federal Water Pollution Control Act Amendments of 1972.

3. All additional effluent requirements established by the State of Tennessee shall be met.

4. A schedule and a proposed method of treatment for achieving the necessary abatement of pollution be provided to EPA, Region IV, by 15 October 1973.

5. The permit issued to this industry require a routine monitoring and sampling program of sufficient detail to ensure compliance with the effluent limits and protection of the receiving water quality.

# E-VIII. HOLSTON ARMY AMMUNITION PLANT-AREA A

## A. GENERAL

The Holston Army Ammunition Plant (HAAP) is located on two separate sites (Area A and Area B) in the vicinity of Kingsport, Tennessee. Area A, within the corporate boundaries of Kingsport, occupies about 134 acres and borders on the South Fork of the Holston River [Figure IV-1]. Area A abuts industrial properties of the Tennessee Eastman Company (TEC) and the ASG Industries.

Area A is the organic acid manufacturing facility of HAAP, whereas Area B is the nitric acid and explosives manufacturing facility. Major processes at HAAP, Area A, include the manufacture and refining of acetic anhydride and the concentrating and refining of acetic acid, principally recovered from HAAP, Area B.

HAAP is the only munitions plant under the auspices of the Army Procurement and Supply Agency (APSA) that is devoted to the manufacture of RDX-HMX explosives. RDX and HMX are admixed with TNT (TNT being received from the outside) and various chemicals, dennensitizing agents, fillers, etc., for primary use in manufacturing military explosives. Additionally, explosives are prepared for the National Aeronautics and Space Administration. HAAP reports the manufacture of about 50 RDX-HMX product variations of which Composition B is the most prominent; it is an extremely powerful explosive made up of RDX, TNT, and wax.

At Area A, waste acetic acid from Area B is concentrated, refined and re-used in process operations. Areas A and B, are interconnected by a railroad spur that is part of the Clinchfield Railroad System and by a series of stainless steel pipelines laid along the railroad tracks which convey raw materials and intermediate products between the two manufacturing facilities.

The Holston Army Ammunition Plant, owned by the Department of the Army, is operated and managed by the Holston Defense Corporation (HDC - a subsidiary of the Tennessee Eastman Company) on a contractual agreement with the Department of the Army. Line command proceeds downward from the Department of the Army through Army Materials Command (AMC) to the Army Ammunition Procurement and Supply Agency (APSA), then Munitions Command (MUCOM), and then to HAAP.

The Department of the Army has undertaken a long-term program for modernizing its munitions and loading facilities. This modernization program, under APSA, spans from 1969-1980 at a projected cost of $2.5 billion. The largest aspects of the program are mechanization, replacement, new construction, and pollution abatement. Modernization program funding is controlled by Congressional appropriation to the U. S. Army Corps of Engineers for military construction, i.e., MCA. The Army is responsible for funding pollution abatement measures necessary to conform to State standards and criteria; the requirements under Federal legislation and Executive Order 11507; and most recently, the best practicable control technology currently available and best available treatment measures as described in the Federal Water Pollution Control Act Amendments of 1972.

HAAP Areas A and B are operated continuously and are staffed by two Army officers, 40 Civil Service personnel, and approximately 1,950 employees of the Holston Defense Corporation. During late 1972, the HAAP manufacturing facilities were being operated at around 43 percent of full capacity.

Permit applications under the 1899 Refuse Act have previously been filed with the U. S. Corps of Engineers for all waste discharges from HAAP, Areas A and B. There are 13 waste outfalls from Area A and 8 outfalls from Area B.

EPA personnel from NFIC-Denver and Cincinnati, and Region IV, Atlanta, Georgia together with Tennessee State Health Department representatives met with HAAP personnel at Kingsport, Tennessee, on 16 October 1972. They discussed process operations and the pollution potential of existing wastewater streams. Considerable information was obtained but Federal and State representatives did not view the process or wastewater operations. Subsequently, the EPA personnel conducted industrial site and river water pollution surveys. Area A, was studied from 30 November to 3 December 1972. Mr. Robert Banner, Jr., Chemical Engineer at HDC; provided information and assistance during the industrial surveys.

## B. UTILITIES AND WATER SUPPLY

HAAP, Area A, purchases electricity, potable water (approximately 200,000 gal./day), and domestic sewer services from the City of Kingsport. Area A has a central steam generating plant consisting of seven boilers fired by "non" low sulfur content coal. Furnace fly ash is slurried into a 4 ft by 4 ft settling compartment followed by a 10 ft by 20 ft pit having continuous overflow. Coal is also utilized in the manufacture of producer gas at HAAP A. The producer gas is added to the cracking furnaces in forming the acetic anhydride. Producer gas is basically a gaseous fuel formed from the incomplete combustion of coal or coke, and consisting mostly of nitrogen, carbon monoxide, hydrogen and carbon dioxide. It is also a viable source of phenolics in resulting wastewaters.

Various amounts of water for cooling and process needs are withdrawn from the South Fork of the Holston River; previously reported figures on total withdrawals vary considerably. River water is diverted into a canal located on the south bank of the South Fork and originating a short distance upstream of the Tennessee Eastman Company waste outfalls. River water enters Area A via a pump station with attendant trash racks. A portion of this flow is treated on-site. Average river water intake varies from about 45 to 65 mgd. The cooling water (once-through) flows for the total facility range from 42 to 60 mgd; process water flows range from 0.8 to 4.4 mgd. The wide range in water use figures reportedly is due to the lack of precise measurement of incoming water flows.

This study assumes that approximately 42 mgd is employed for once-through cooling and 0.8-0.9 mgd for processing at Area A. Furthermore, recent data from HAAP indicate that about 1.5 mgd of intake water is treated (softened and filtered) of which about 0.8 mgd is used for boiler feed and 0.7 mgd for process waters. Spent cooling waters, waterworks filter sludges, and industrial process wastewaters from Area A are discharged without treatment to the South Fork of the Holston River.

## C. PROCESS OPERATIONS AND WASTE SOURCES

The general layout of manufacturing buildings at Area A is shown in Figure E-10. A simplified flow sheet of Area A is presented in Figure E-11. The major processes conducted at Area A are as follows:

1. Concentration and refining of waste acetic acid (received from HAAP B) by means of azeotropic distillation units in Building 2 yields an acetic acid whose concentration is increased from 60 percent to approximately 99 percent pure (glacial acetic acid). About one-third of the glacial acetic acid is returned to Area B for explosives manufacturing; two-thirds are employed in the manufacture (within Area A) of 98 percent acetic anhydride. Interim storage of the refined acid (99 percent pure) is provided for in the tank farm areas.
2. Acetic anhydride manufacturing is carried out (in Buildings 7 and 20) by first catalytically cracking glacial acetic acid in special cracking furnaces (fueled by producer gas) and secondly absorbing the cracking products in glacial acetic acid to yield the crude anhydride, which is then refined (Building 6).
3. Generation of producer gas (Building 10) is carried out upon demand by the cracking furnaces in the acetic anhydride manufacturing processes.
4. Refining of the crude anhydride by distillation (Building 6) produces a high purity acetic anhydride, required for the various explosives manufacturing operations in HAAP, Area B. It should be noted that Building 6 has two distinct functions: a) acetic anhydride refining and b) azeotropic distillation to purify and concentrate acetic acid.

5. Mechanical refrigeration services (Building 5)
6. Generation of steam with coal fired boilers (Building 8) provides for the needs of the entire HAAP, Area A complex.

Acetic Acid Concentration and Refining--Building 2

In azeotropic distillation, the nearly pure acetic acid is withdrawn from the bottom of the column, and the *n*-propylacetate-and-water mixture is removed from the top of the column and condensed. Separation of water from the acetate is accomplished by decantation. The propyl acetate is then returned to the azeotropic distillation column. The decanted waters are passed through a flash column for further solvent recovery before they are discharged to the sewer.

During distillation there is a undesirable buildup of solids in the distillation column. Sludge bleedoff is necessary, with this material being sent to a sludge-heating operation. Under elevated temperature and vacuum, additional acetic acid is distilled and recovered via the overhead streams until the acid concentration falls below the level deemed economically recoverable. At this point the sludges are dumped into the sewer. Sludge heating is a batch operation. Exhausted sludges are dumped sporadically, between two to four times each week. Occasionally spent sludges contain heavy metals (including Cr, Cu, Fe, and Mn) from the corrosive destruction of materials which form the distillation columns.

Flash column effluent waters and sludge heater wastes are cited in the 1971 Army Environmental Hygiene Agency (AEHA) Report as totaling 24,000 gpd and 16,000 gpw, respectively. However, the 1971 MUCOM

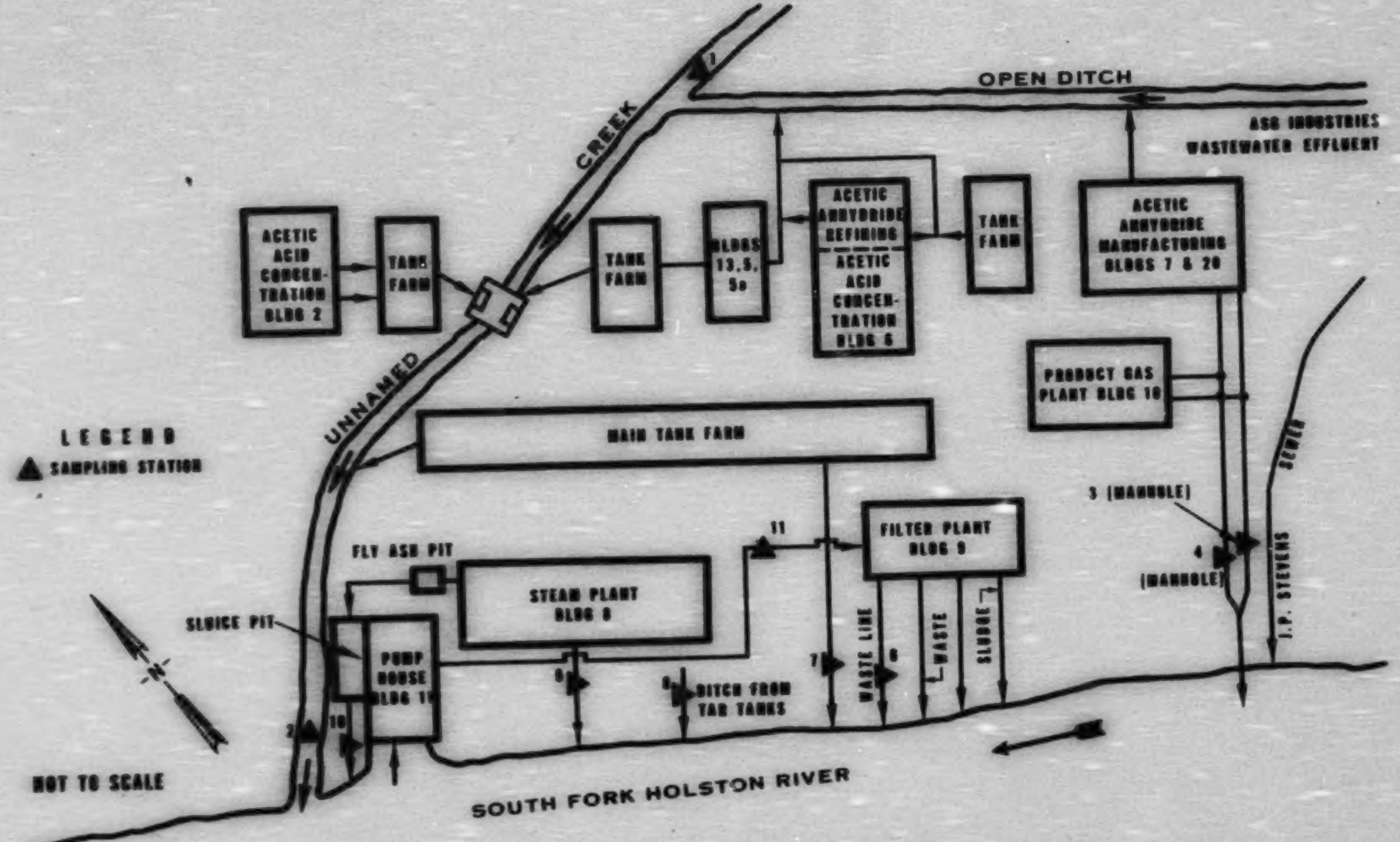
OPEN DITCH
ASG INDUSTRIES
WASTEWATER EFFLUENT
CREEK
UNNAMED
1
ACETIC ACID CONCENTRATION BLDG 2
TANK FARM
TANK FARM
BLDGS 13, 5, 5a
ACETIC ANHYDRIDE REFINING
ACETIC ACID CONCENTRATION BLDG 6
TANK FARM
ACETIC ANHYDRIDE MANUFACTURING BLDGS 7 & 20
PRODUCT GAS PLANT BLDG 10
MAIN TANK FARM
SEWER
3 (MANHOLE)
4 (MANHOLE)
I.P. STEVENS
LEGEND
SAMPLING STATION
FLY ASH PIT
11
FILTER PLANT BLDG 9
STEAM PLANT BLDG 8
SLUICE PIT
PUMP HOUSE BLDG 11
8
9
DITCH FROM TAR TANKS
7
WASTE LINE
6
WASTE
SLUDGE
2
10
N
NOT TO SCALE
SOUTH FORK HOLSTON RIVER

Figure E-10. Plant Layout- Holston Army Ammunition Plant-Area A
Kingsport, Tennessee

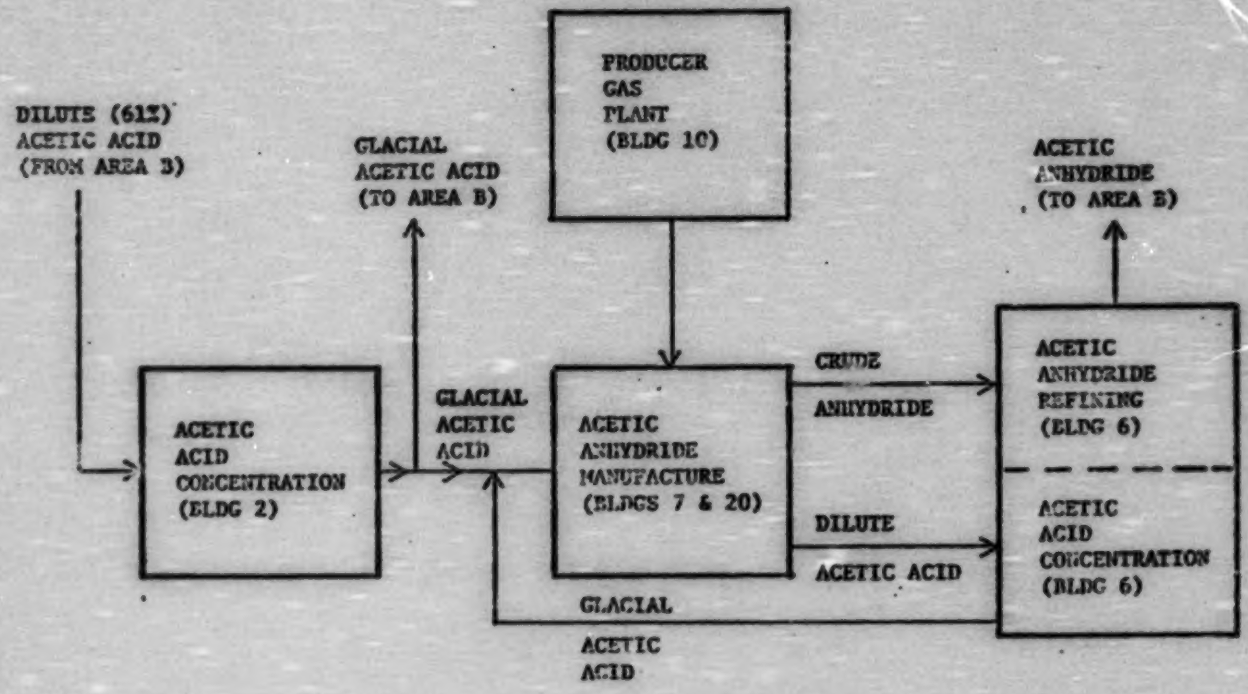
DILUTE (61%) ACETIC ACID (FROM AREA B)
ACETIC ACID CONCENTRATION (BLDG 2)
GLACIAL ACETIC ACID (TO AREA B)
GLACIAL ACETIC ACID
PRODUCER GAS PLANT (BLDG 10)
ACETIC ANHYDRIDE MANUFACTURE (BLDGS 7 & 20)
CRUDE ANHYDRIDE
DILUTE ACETIC ACID
GLACIAL ACETIC ACID
ACETIC ANHYDRIDE REFINING (BLDG 6)
ACETIC ACID CONCENTRATION (BLDG 6)
ACETIC ANHYDRIDE (TO AREA B)

Figure E-11. SIMPLIFIED FLOWSHEET-AREA A, HOLSTON ARMY AMMUNITION PLANT

Courtesy of USAEHA, Edgewood Arsenal,
Aberdeen Proving Ground, Maryland
Taken from USAEHA Study No. 24-021-71/72

report for HAAP reports a process wastewater flow of 312,000 gpd from Building 2 (also, presumably for the decant waters). These process effluents range in pH from 2.8 to 3.8 and contain nitromethane, methyl nitrate, acetic acid, *n*-propyl acetate, nitric acid and trace amounts of explosives.

Cooling and condensing water usage (in Building 2) for the distillation units and peripheral operations are estimated as 24.0 mgd. Acetic acid (99 percent) production is about 1.3 to 1.6 million lb/day. Cooling waters, process waters and sludges are mixed in the Building 2 industrial sewer and discharged into the "Main Outfall Ditch" adjacent to Building 2. This ditch was sampled at Station 2 during the NFIC-D, 1972 survey, immediately before its entry into the South Fork of the Holston River [Figure E-10].

Another pollution source from the acetic acid operations (Building 6), is vent gas from the azeotropic distillation columns. Under current production rates, these vent gases contain about 530 lb/day of methyl nitrate liberated in a total, untreated mixture of nitromethane, methyl acetate, propyl formate, propyl acetate and methyl nitrate. The weight of solvent vapors vented to the atmosphere approaches some 1,070 lb/day. Methyl nitrate is toxic and highly explosive.

## Acetic Anhydride Manufacturing--Buildings 7 and 20

Glacial acetic acid (from Building 2) is vaporized and fed to the cracking furnace (in Buildings 7 and 20) together with triethyl phosphate, a reaction catalyst. Furnace vapors are passed through a condenser which separates the process stream into a) uncondensed vapors and

b) unreacted acetic acid obtained from the bottom of the condenser. The unreacted acid is sent to Building 6 for re-concentration.

Uncondensed vapors are directed through a series of five scrubbing units; the primary, secondary, anhydride, weak acid and water scrubbers. The scrubbers employ recycling of feed, bottoms, and intermediate product streams. The vapor stream is scrubbed with glacial acetic acid, and ketene originating from catalytic cracking is absorbed to form the anhydride. Crude anhydride is taken off the bottom of the secondary scrubber and subsequently sent to the distillation unit (Building 6) for refining. Wastewaters from acetic anhydride production (Buildings 7 and 20) are principally generated at the fifth (i.e. the water) scrubbing unit. Vapors entering the fifth unit are scrubbed with water; after a single pass they enter a drain sump and the plant sewer. Non-condensables off the top of the fifth unit are captured in a barometric condenser that likewise discharges to the drain sump. Both the barometric system and drain sump are vented to rid the production area of noxious fumes. It is likely that drips, leaks, spills, etc., in the production area are also directed to the drain sump.

Spent gases from the cracking furnaces are sent to a waste heat boiler that receives deionized water for low pressure steam generation. Flue gas from the boiler, in addition to any unburned producer gas, is directly vented to the atmosphere.

The flow of the process wastewater streams that include the water scrubber discharges and barometric condensates previously mentioned ranges from 500,000 to 550,000 gpd. These wastewater streams are reported to contain acetic anhydride, acetic acid, acetaldehyde, acetonitrile, methyl acetate, methyl nitrate, ethanol, methanol, ethyl acetate, propanol, propyl acetate, etc. A previous Army report equates the water scrubber discharge to 3,100 lb BOD/day.

The volume of the cooling waters for anhydride manufacturing amount to 2.0 to 2.3 mgd which are mixed with process wastewaters in the building sewer for discharge to the South Fork of the Holston River. These discharges were collectively measured and analyzed at the Process Waste Outfall (Station 3) during the EPA survey, 30 November-3 December 1972. The conditions just expressed are representative of acetic anhydride production rates in the range of about 510,000 to 640,000 lb/day.

Pollutants similar to those found in the wastewater streams can be expected in the various off-stream gases vented to the atmosphere (from Buildings 7 and 20). Of the contaminants resulting from anhydride manufacturing some 16,500 lb/day of air pollutants are estimated to be currently discharged (from Buildings 7 and 20); this total is comprised of 5,440 lb/day of hydrocarbons, 6,360 lb/day of carbon monoxide and 4,700 lb/day of carbon dioxide mixed with hydrogen.

## Producer Gas Plant--Building 10

Producer gas manufacturing facilities (Building 10) are rated at a capacity of about 2.0 million cubic feet of gas per day. A heated, saturated steam-air mixture is added to coal, burning in the gas producer furnaces, where combustion is maintained around 1,100°F. Ashes are withdrawn from the bottom of the furnaces and disposed of by removal to a landfill.

The products of this combustion pass through water sprays, a tar trap, and then into two large water scrubbing units in series. Scrubbing removes dust, tars, phenolics, etc. from the gases but these pollutants then find their way into the wastewater flows. Spent water from the header sprays and the scrubbing units is decanted for removal of tars which are sent to the steam plant as fuel. Decanter effluents flow through a cascade cooler prior to being recycled to the sprays and scrubbers or are discharged to the plant sewer. Total water usage and ensuing wastewater discharges associated with the manufacture of producer gas heavily depend upon the degree of recycling of decanter effluents back into the system. The Army reports that flows of "excess" cooling and condenser water from the producer gas building amount to from 170,000-180,000 gpd. Flow measurements made at Station 4 during the 1972 EPA survey (November-December) 1972 indicate the wastewater contribution from Building 10 was many times higher than that reported by the Army. However, wastewater loads from this plant, as measured at both Stations 3 and 4 (EPA survey stations), were reflected, within the results obtained.

Other pollution sources within the producer gas area include sludges from an on-site evaporator and cleanout of the tar traps. These materials are disposed of at a sanitary landfill. Air contaminants from the producer gas furnace vent gases include particulate matter, and sulfur and nitrogen oxides.

General operations data indicate that approximately 56 cu ft of producer gas are obtained for each pound of coal burned and that about

14.3 cubic feet of producer gas are consumed per pound of crude acetic anhydride formed.

## Acetic Anhydride Refining--Building 6

Building 6 actually houses two different process operations: acetic anhydride refining, accomplished by distillation, and acetic acid concentration accomplished by azeotropic distillation. Anhydride refining constitutes the major operation. Crude anhydride is received from the dehydration process (Buildings 7 and 20) or from storage tanks, whereas the low-grade acetic acid is obtained as a by-product of the anhydride refining columns.

Crude anhydride, acetic acid and impurities are received into two-stage refining columns heated in the lower stage. Refined anhydride is withdrawn from the lower stage, sent to a second (small) column for removal of color bodies, and is then ready for storage or pipeline transport to HAAP, Area B. The vapors from the top of the two-stage anhydride column contain acetic acid, 15 percent anhydride plus some impurities. This vapor is condensed, part being returned to the refining column and the majority sent to a stripping column. In stripping, separation is made into a) acetic acid and anhydride (off the bottom of the stripper) which are returned to the refining column, and b) 90-percent acetic acid vapors off the top of the stripper. These vapors serve as the feed for the azeotropic stills (located in Building 6).

Azeotropic distillation of acetic acid for purification and concentration is similar to that performed in Building 2 (production of 99 percent pure acid). In Building 6 the acetic acid feed to the stills contains low-boiling compounds that must be removed before azeotropic distillation. Prior to distillation, the feed is passed through a stripping column, to reduce the low boilers and release these compounds to the atmosphere. Vented streams contain acetonitrile, methyl acetate, acetaldehyde, methanol, ethanol, methyl nitrate, ethyl acetate, propanol and propyl acetate, all of which then become air pollutants. Other sources of air pollution exist in Building 6. The major source is the azeotropic stills, for which there is no waste load information presently available.

Sludge bottoms from the various stills in Building 6 are recovered. Sludges from the refining columns are sent to a ball mill, then heated under vacuum to distill off additional acetic anhydride. When the anhydride falls below an economically recoverable level, the sludges are dumped to the sewer, a daily occurrence. Sludges from the azeotropic stills, because of their anhydride origin, receive preparatory treatment by sulfuric acid to break down the acetamide in the sludges. The sludges are then sent to sludge heaters and handled in a similar fashion to those in the acetic acid purification process (Building 2). In like manner exhausted azeotropic still sludges are eventually discharged into the plant sewer.

Process wastewater sources from anhydride refining (Building 6) include a) 70,000 gpd ball mill sludges containing carbon polymers, acetic anhydride, etc.; b) 8,100 gpd of sludge heater sludges that are dumped four times per week — containing carbon, ammonium phosphate, acetamide, and various polymers; and c) flash column effluent, in the acetic acid concentration area, having unknown volume but found to contain acetone, ethyl acetate, acetonitrile, and methyl cyanide.

Total spent cooling and condensing waters from anhydride refining (Building 6) are estimated by the Army as around 9.5 mgd. All spent flows leaving Building 6 are untreated and mixed together in the industrial plant sewer. These streams were collectively analyzed with other wastewaters passing Station 2 during the EPA 1972 survey. Conditions described are representative of acetic anhydride production in the range of 600,000 to 700,000 lb/day and acetic acid production of 120,000 to 150,000 lb/day.

## Mechanical Refrigeration--Building 5

The anhydride scrubber medium (in Buildings 7 and 20) is cooled by an ethylene glycol solution. The glycol, after use, is cooled by mechanical refrigeration equipment (located in Building 5) and, in a closed loop system, is returned to the anhydride units. Spent cooling waters from the refrigeration operation (Building 5) have been estimated to range from 0.164 to 2.3 mgd. These waters are expected to contain substantial amounts of heat.

## Steam Generation at Steam Plant--Building 8

Except for a single boiler that employs pulverized coal, steam-producing boilers (Building 8) are stoker fired. Tar sludges received from the producer gas builing are also put into the boilers. Boiler feed consists of a mixture of deionized water and return steam condensates. In order to minimize corrosion in the boilers, sodium sulfite is added to the feed waters. Sodium phosphate is added directly to the boiler drums to reduce corrosion and scale formation on the boiler tubes. The boilers are blown down more or less continuously so as to prevent too high a solids concentration in the boiler system. Both high and low-pressure steam are produced for needs throughout Area A. Compressed air requirements for Area A are met by equipment within Building 8.

Spent ashes from the bottom of the boilers are slurried into an ash pit followed by a sluice pit. The overflow from the sluice pit is estimated from 100,000 to 140,000 gpd; the flow was sampled at EPA survey Station 10. The Army describes this water as strong in phosphates and sulfites. Pump gland drainage from the water pumping house adjacent to the steam plant also contributed a considerable amount of flow passing EPA Station 10.

Boiler blowdown is released into the drainway, monitored by Station 9 during the EPA survey. This discharge reportedly has a high temperature and contains significant quantities of phosphates, sulfates and sulfites. The Army has provided a flow figure for boiler blowdown (from Building 8) of approximately 30,000 gpd although survey results for Station 9 indicated some 690,000 gpd; this reflects additive wastes such as general washdown and cleanup waters, spills, leaks, or unknown water uses.

Coal tars recovered from the producer-gas building are conveyed to storage tanks directly adjacent to the steam plant. Tar deposits on the grounds around the storage tanks are slowly leached into the drainway on the southeast side of the steam plant and eventually discharged to the South Fork of the Holston River. This drainage was sampled at EPA

Station 8 and shown to be very heavily laden with organics, notably phenolics.

Relative to air pollution from the coal-fired steam plant, substantial abatement could be indicated in the forthcoming period of time. MUCOM, in the 1971 survey of HAAP, indicated that discharge of air pollutants from the boilers amounts to 16,000 lb/day of particulates, 8,000 lb/day of sulfur oxides, plus unknown amounts of other materials.

## D. REFUSE ACT PERMIT APPLICATION (RAPP) DATA

Wastewater characteristics submitted by HAAP in May 1971 have been summarized [Table E-21]. The summary also includes the total waste loads determined by the U. S. Army Environmental Agency (USAEA) and corresponding RAPP and EPA 1972 survey station numbers.

Of the 13 RAPP outfalls, two are inactive (010 and 011) and three (002, 003, and 004) discharge sludge (from the settling basins within the waterworks) to the River, only once every three or four months. However, to say that the waterworks discharge minimum amounts of coagulated sludge is not necessarily true. In fact, it is highly probable that large amounts of settled sludge are being continuously swept out of the sedimentation basins and onto the waterworks filters. The large majority of these chemical sludges are likely being flushed to the river on a routine daily basis via the unloading and backwashing of the filter beds through RAPP outfall 005 (EPA 1972 Survey Station 6).

RAPP Outfall 013 (EPA Station 2) reflects the addition of some 0.52 mgd wastewater from ASG Industries introduced upstream of HAAP into this "Main Outfall Ditch," which in turn discharges into the South

## TABLE E-21

### OUTFALL CHARACTERISTICS FROM RAPP APPLICATION, HOLSTON ARMY AMMUNITION PLANT - AREA A
### KINGSPORT, TENNESSEE

| RAPP Outfall Number | EPA Sta. No.[a] | Flow mgd | BOD | | COD | | SS | | NH3-N | | NO3-N | | P-Total | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | mg/l | lb/day | mg/l | lb/day | mg/l | lb/day | mg/l | lb/day | mg/l | lb/day | mg/l | lb/day |
| 001 | 3,4 | 4.9 | 4 | 163 | 47 | 1,909 | 18 | 731 | - | - | 1 | 40 | 1 | 49 |
| 002 | b/ | 0.3 | 56 | 140 | 1,233 | 3,082 | 8,112 | 20,274 | - | - | - | - | - | - |
| 003 | b/ | 0.3 | 56 | 140 | 1,233 | 3,082 | 8,112 | 20,274 | - | - | - | - | - | - |
| 004 | b/ | 0.3 | 1 | 4 | - | - | 22 | 55 | - | - | - | - | - | - |
| 005 | 6 | 0.05 | 5 | 2 | 62 | 26 | 50 | 21 | - | - | - | - | - | - |
| 006 | 7 | 0.01 | 84 | 7 | 276 | 23 | 96 | 8 | - | - | - | - | - | - |
| 007 | b/ | 0.03 | 5 | 1 | 320 | 80 | 20 | 5 | - | - | - | - | - | - |
| 008 | 8 | 0.0005 | - | - | 3,600 | 15 | - | - | - | - | - | - | - | - |
| 009[c] | 9 | - | - | - | - | - | 8 | 4 | - | - | - | - | - | - |
| 012 | 10 | 1.1 | 2 | 20 | 69 | 634 | 85 | 781 | - | - | - | - | - | - |
| 013 | 2 | 33.3 | 34 | 9,443 | 60 | 16,643 | 93 | 25,828 | 10 | 278 | 12 | 333 | 15 | 417 |
| TOTALS | | 40.3 | | 9,920 | | 25,514 | | 67,981 | | 278 | | 373 | | 466 |
| TOTALS FROM USAEHA REPORT[d] | | 37.6 | | 9,359 | | 13,200 | | 6,060 | | | | 650 | | 259 |

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a/ These station numbers refer to the 1972 study.
b/ This outfall was not sampled.
c/ Outfalls 010 and 011 are inactive discharges.
d/ This refers to the U.S. Army Environmental Hygiene Agency Report (19 March - 28 June 1971).

Fork of the Holston River. [For EPA 1972 Survey Stations, see Figure E-10.]

## E. DISCUSSION OF 1972 EPA FINDINGS

During the EPA field sampling survey of 30 November to 3 December 1972 ten wastewater sampling stations were established [Figure E-10 and Table E-22]. Major wastewater streams include Stations 2, 3, and 4. Stations 2 through 4 and 7 through 10 were manually sampled at two-hr intervals for 72 consecutive hours beginning at 8:00 AM, 30 November. [See Appendix B for description of Sampling Procedure.] These grab samples were composited on an equal volume basis into three 24-hr composite samples. At Station 6 the ion exchange regeneration wastes and filter backwash from the water works were grab sampled at times of discharge. Unnamed Creek (background location) and the plant raw water intake, respectively Stations 1 and 11, were sampled twice daily and composited into daily samples. Data on waste loads from ASG Industries (discharges into open ditch that flows into the main outfall ditch) was obtained with concurrent sampling and were extracted from the results of the 1972 NFIC-D & C survey findings on ASG Industries.

At Stations 2, 3, and 7 through 10 special samples for analyses of oil and grease and of phenolic materials were taken every two hr and continuously composited over a 24 hr period. At Station 6 grab samples for oil and grease analysis were collected twice each day and composited into a daily sample. Temperature, pH, and conductivity were measured each time a sample was collected. [See Appendix D for Methods of Analysis and Sample Preservation.]

EPA flow measurements were made at the following stations:

# TABLE E-22

## EPA SAMPLING STATIONS, HAAP, AREA A, KINGSPORT, TENNESSEE
## EPA SURVEY OF 30 NOVEMBER-3 DECEMBER 1972

| Survey Station Number | Refuse Act Permit Discharge Number | Type Sample | Station Location |
|---|---|---|---|
| 1 | | 2 Grab/Composite | Unnamed Creek, upstream from confluence with HAAP "A" discharge |
| 2 | 013 | Composite | Main Outfall stream, at chain like fence near river bank |
| 3 | 001 | Composite | Process waste outfall at manhole 8, prior to mixing with "manhole 7 wastes" and discharge to South Fork of the Holston River |
| 4 | 001 | Composite | Process waste outfall at manhole 7, prior to mixing with "manhole 8 wastes" and discharge to the river. |
| 6 | 005 | Grabs | Zeolite regeneration wastes and backwash from waterworks |
| 7 | 006 | Composite | Process waste outfall to the river originating from main tank farm |
| 8 | 008 | Composite | Leached wastes from area of tar tanks on discharge line close to the river bank |
| 9 | 009 | Composite | Floor drainage and steam-plant effluent at manhole on outfall. |
| 10 | 012 | Composite | Discharge from steam plant, principally an ash pit overflow, together with pump gland drainage originating from (water) pump house |
| 11 | | 2 Grab/Composite | Raw water intake into water works |

1. Stations 3, 4, 7 - measured every 2 hr with a Marsh-McBirney electromagnetic water-current meter.
2. Stations 1 and 2 - gaged several times daily and rating curves were established.
3) Station 8 - flow recorder was installed for continuous measurement.

Flow data for remaining sampling stations were extracted from HAAP records and/or generally compiled from special Army studies.

The EPA 1972 survey revealed a total (net) wastewater discharge from HAAP, Area A, of 43.3 mgd, but the 43.3 mgd does not include ASG Industrial Wastewater discharges and the natural flow in Unnamed Creek that contribute to overall flows in the "Main Outfall Ditch." The RAPP applications reported a total water intake of 65 mgd pumped from the South Fork of the Holston River. Because the USAEHA 1971 waste survey showed only 37.6 mgd of wastewaters being discharged from Area A, HDC decided to measure, during June to July 1972, the total plant intake water with pitot tubes during June-July, 1971, and consequently the survey showed an average intake flow of 48.7 mgd. Of course the EPA figure of 43.3 mgd reflects spent waters leaving HAAP, Area A, and does not take into account water lost in product, evaporation and steam losses, and some 0.35 mgd of pumphouse trash rack wastewater.

The complex nature of pollutants contained in the wastewater from Areas A and B, presented unusual difficulty to EPA personnel who conducted the analyses. It is likely that the important waste characterization parameters of BOD, COD, and TOC were affected in varying degree by the kind of wastewaters encountered. Many HAAP wastes are relatively non-biodegradable and are potentially toxic to biological life, hence yielding comparatively low BOD values. The presence of acetic acid, straight-chain aliphatics and aromatic hydrocarbons all of which are prevalent in HAAP wastes, are relatively resistant to COD measurement. Survey results for TOC were noted as exceptionally low relative to the BOD and COD values, leading one to suspect some interference in these determinations. Procedural difficulties were also experienced in undertaking the complex organic analyses. Refined analytical methods and possibly some research on modified analytical techniques, directed specifically to HAAP-type wastewaters, would seem advisable. Results for BOD, COD, and TOC, obtained from the EPA 1972 sampling survey, are considered to represent the near minimum values.

Specific water and wastewater sampling results obtained from the 30 November to 3 December 1972 EPA survey of the HAAP A installation are discussed as follows: [The summary of analytical data from the EPA survey is presented in Table E-23.]

### Unnamed Creek At Station 1

This creek had a natural average flow of 0.69 mgd, and the water quality was similar to that found in the South Fork of the Holston River (as compared to plant water intake at Station 11) except for slight increases in values of BOD and conductivity.

### Main Outfall From HAAP, Area A, Station 2

The main outfall from Station 2 collects the majority of spent

## TABLE E-23

## SUMMARY OF FIELD MEASUREMENTS AND CHEMICAL DATA
## HOLSTON ARMY AMMUNITION PLANT AREA A
## KINGSPORT, TENNESSEE
## 1-3 DECEMBER 1972

| Station Number | 1 | | 2 | | 3 | | 4 | |
|---|---|---|---|---|---|---|---|---|
| Station Description[a] | Unnamed Creek Upstream (RM 142.15/4.04) | | Main Outfall Ditch (RM 142.15/4.04) | | Process Waste Outfall (RM 142.15/4.30) | | Process Waste and Cooling Water Outfall (RM 142.15/4.30) | |
| Parameter[b] | Range | Average | Range | Average | Range | Average | Range | Average |
| Flow (mgd) | 0.52-0.96 | 0.69 | 33.5-33.7 | 33.6 | 3.97-5.40 | 4.65 | 3.88-4.96 | 4.40 |
| pH (standard units), range | 6.9-7.0 | | 6.2-7.6 | | 6.2-7.4 | | 6.1-7.5 | |
| Temperature (°C), range | 5.5-6.0 | | 18.0-20.0 | | 14.0-16.0 | | 14.0-17.0 | |
| Conductivity (µmhos/cm), range | 320-480 | | 160-300 | | 200-350 | | 180-360 | |
| BOD | 2.4-5.8 | 3.80 | 56-71 | 65 | 20-75 | 41 | 4.6-12 | 8.5 |
| BOD (lb/day) | | 24 | | 18,800 | | 1,500 | | 320 |
| COD | | | 64-66 | 65 | | | | |
| TOC | 6-8 | 6.7 | 6-11 | 8.7 | 4-29 | 14 | | |
| Total Solids | 193-326 | 276 | 133-164 | 147 | 123-138 | 132 | 125-211 | 160 |
| Suspended Solids | 10-45 | 29 | 3-21 | 9.6 | 4-14 | 9 | 8-22 | 15 |
| Suspended Solids (lb/day) | | 190 | | 2,700 | | 350 | | 520 |
| Total Kjeldahl Nitrogen-N | N.D.[c] | | <0.5-0.5 | <0.5 | <0.5-0.5 | <0.5 | <0.5-0.6 | <0.5 |
| $NH_3$-N | N.D. | | N.D. | | N.D. | | N.D. | |
| $NO_2$ + $NO_3$-N | 0.5-1.8 | 0.9 | 0.8-1.9 | 1.3 | 0.8-1.0 | 0.9 | 1.0[d] | 1.0 |
| $NO_2$ + $NO_3$-N (lb/day) | | 6.30 | | 354 | | 35.0 | | 36.7 |
| Total Phosphorus-P | 0.28-0.67 | 0.45 | 0.19-0.22 | 0.21 | 0.18-0.20 | 0.19 | 0.12-0.14 | 0.15 |
| Total Phosphorus-P (lb/day) | | 2.80 | | 57.9 | | 7.24 | | 5.52 |
| Oil and Grease | 2-3 | 2 | | | <1-2 | <1 | | |
| Phenols | N.D. | | N.D. | | N.D. | | N.D. | |

TABLE E-23 (Cont.)

SUMMARY OF FIELD MEASUREMENTS AND CHEMICAL DATA
HOLSTON ARMY AMMUNITION PLANT AREA A
KINGSPORT, TENNESSEE
1-3 DECEMBER 1972

| Station Number | 6 | | 7 | | 8 | | 9 | |
|---|---|---|---|---|---|---|---|---|
| Station Description[a] | Filter Plant Backwash (RM 142.15/4.25) | | Tank Farm Wastes (RM 142.15/4.24) | | Tar Tank Area (RM 142.15/4.20) | | Steam Plant Effluent (RM 142.15/4.19) | |
| Parameter[b] | Range | Average | Range | Average | Range | Average | Range | Average |
| Flow (mgd) | | 0.04[e] | | 0.18 | 0.005-0.008 | 0.007 | | 0.69[e] |
| pH (standard units), range | 6.4-7.1 | | 4.5-7.6 | | 5.8-8.1 | | 6.7-11.2 | |
| Temperature (°C), range | 9.5-10.3 | | 14.0-24.0 | | 13.0-65.0 | | 15.0-21.5 | |
| Conductivity (µmhos/cm), range | 280-360 | | 200-460 | | 500-26,000 | | 220-640 | |
| BOD | 22-36 | 29 | 20-32 | 26 | >800->2,700 | >2,030 | 6.9-7.2 | 7.1 |
| BOD (lb/day) | | 9.7 | | 37 | | >122 | | 40 |
| COD | | | | | 4,800-10,600 | 7,957 | | |
| TOC | 7-18 | 12.5 | 3-7 | 5 | 1,300-2,800 | 2,130 | 3-8 | 5 |
| Total Solids | 229-475 | 352 | 72-268 | 173 | 2,400-5,300 | 4,020 | 196-202 | 199 |
| Suspended Solids | 118-236 | 177 | 7-57 | 25 | 64-98 | 84 | 15-47 | 27 |
| Suspended Solids (lb/day) | | 59 | | 29 | | 4.5 | | 160 |
| Oil and Grease | | | <1-2 | 1 | 31-89 | 63 | <1-3 | 2 |
| Phenols | <0.01-0.04 | 0.023 | | | 1,100-5,800 | 3,600 | 1.3-5.0 | 2.1 |
| Phenolics (lb/day) | | | | | | 202 | | 12.1 |

### TABLE E-23 (Cont.)

### SUMMARY OF FIELD MEASUREMENTS AND CHEMICAL DATA
HOLSTON ARMY AMMUNITION PLANT AREA A
KINGSPORT, TENNESSEE
1-3 DECEMBER 1972

| Station Number | 10 | | 11 | |
|---|---|---|---|---|
| Station Description[a] | Sluice Pit Outfall<br>(RM 142.15/4.10) | | Raw Water Intake<br>(RM 142.15/4.08) | |
| Parameter[b] | Range | Average | Range | Average |
| Flow (mgd) | | 1.0[e] | | 48.7[e] |
| pH (standard units), range | 6.5-8.2 | | 6.1-6.9 | |
| Temperature (°C), range | 27.5-38.0 | | 9.0-10.0 | |
| Conductivity (μmhos/cm), range | 150-320 | | 240-280 | |
| BOD | 2.9-3.9 | 3.4 | 1.0-1.4 | 1.1 |
| BOD (lb/day) | | 28 | | 460 |
| COD | 57[f] | 57 | | |
| TOC | 8-17 | 11 | 2-4 | 3.3 |
| Total Solids | 161-173 | 167 | 125-143 | 134 |
| Suspended Solids | 16-36 | 29 | 6-35 | 22 |
| Suspended Solids (lb/day) | | 240 | | 8,800 |
| Total Kjeldahl Nitrogen-N | | | <0.5-0.5 | <0.5 |
| $NH_3$-N | | | N.D | |
| $NO_2$ + $NO_3$-N | | | 1.0[d] | 1.0 |
| $NO_2$ + $NO_3$-N (lb/day) | | | | 406 |
| Total Phosphorus-P | | | 0.06-0.22 | 0.12 |
| Total Phosphorus-P (lb/day) | | | | 47.4 |
| Oil and Grease | <1-2 | <1 | | |

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[a] See Table 2 for station description.
[b] All values reported as mg/l, except where otherwise specified.
[c] N.D. - None Detected.
[d] All values are the same.
[e] The flow was determined from RAPP application.
[f] This is based on one value.

cooling- and process-water flows from the Area A manufacturing facilities. An average flow of 33.6 mgd was observed within the large drainway that includes some 0.52 mgd wastewater flow contributed by the ASG Industries and the respective flow of Unnamed Creek [Figure E-10]. The creek carries a negligible waste load into the drainway, but the ASG pollution loads are equivalent to 3,600 lb/day suspended solids added to the upper section of the Main Outfall. However, some solids rapidly settle out, both within the open drainage ditch and within parts of the Main Outfall. Near its terminus point at Station 2 it was found to be conveying average loads of 18,800 lb/day BOD; 18,200 lb/day COD; and 2,700 lb/day suspended solids directly into the South Fork of the Holston River. Using any criterion of measurement, these are very large waste loads. More than 90 percent of the total BOD and COD loads discharged from Area A were found in this single outfall. Surprisingly so, at least during the three-day survey, no phenolic materials were detected at this location, and nutrient levels were fairly similar to background waters. No detectable amounts of heavy metals were found at Station 2. However, a number of metals sources exist within the HAAP A complex, especially from the sludge-heater system and corrosion of the aezotropic distillation columns (Buildings 2 and 6). These could contribute to a metals problem. Using fathead minnows as the test fish species, bioassay studies were conducted on a 24-hr composite sample of the Main Outfall, the 96-hr $TL_m$ (50 percent fish kill) obtained from static bioassays was 56.0 percent of the wastewater concentration. When one considers the magnitude of flow at Station 2, these toxicity results are highly significant as will be explained later in this report.

## Two Process Waste Outfalls, Stations 3 and 4

Outfalls at Stations 3 and 4 are located in a vertical plane one above the other and eventually join together prior to their combined discharge into the South Fork of the Holston River. These outfalls contain various spent process and cooling waters from the producer gas plant (Building 10), and the acetic anhydride manufacturing areas (Buildings 7 and 20). These two drains comprise the second largest BOD load from Area A into the South Fork of the Holston River. The combined discharge was about 9 mgd containing 1,820 lb/day BOD, 680 lb/day TOC, and 870 lb/day of suspended solids.

## Outfall At Station 6

This outfall originates from the HAAP A waterworks and carries ion exchange regeneration wastes and sludges from filter bed backwashing. This outfall discharges on an irregular schedule. Previous data (from the U.S. Army Environmental Hygiene Agency) indicate 40,000 gpd being discharged via this outfall. A wide discrepancy exists between this flow figure and the 1-million-gpw figure of waterworks sludge mentioned in the November 1971 MUCOM report for HAAP A. Waste loads from this outfall, at least as measured by the EPA Survey, were relatively minimal. Still remaining are questions as to the frequency and magnitude of sludge loads released from the other three waterworks outfalls. The dumping of water treatment sludges into receiving streams is unsatisfactory.

## Tank Farm Area Drainage, Station 7

Drainage from the main tank farm area (principally acetic acid storage) averaged 188,000 gpd containing mean BOD and suspended solids loads of 37 lb/day and 38 lb/day, respectively. However the pH values were somewhat erratic, ranging from 4.5 to 7.6. Spills and inadvertant waste releases associated with HAAP chemical storage areas are treated later in this report.

## Tar Tank Storage Area, Station 8

The leachate and drainage accruing from the grounds around the tar tank storage area, measured at Station 8, amounted to about 7,000 gpd and was categorized as a noxious and heavy organic-laden waste stream. Average BOD, COD, and TOC values were, respectively, greater than 2,030 mg/l, 7,960 mg/l, and 2,130 mg/l. Concentration of phenolics was found to be 3,600 mg/l. This discharge, upon entering the South Fork of the Holston River, caused an intense reddish coloration, detectable about 100 yd into the main river. Waste loads in this outfall approximated 460 lb/day COD and 200 lb/day of phenolics. Flow-through bioassay studies were conducted on this waste stream. Results, with fathead minnows as the test species, disclosed that a 0.17 percent waste concentration would kill one-half of the test fish within 96 hr. This toxicity is within the same range as some of the more potent pesticides.

## Steam Power Plant, Station 9

Boiler blowdown and floor and miscellaneous drainage from the steam power plant, as measured at Station 9, yielded an average discharge of 0.69 mgd, containing BOD, suspended solids, and phenolics loads amounting to 40 lb/day, 160 lb/day and 12 lb/day, respectively. The phenolics are probably attributable to coal tar and/or coal used as fuel for the boilers.

## Ash Pit Overflow and Pump Seepage, Station 10

Ash pit overflow (originating from the steam plant), together with packing gland seepage from pumps in the water intake house, were measured at Station 10. HAAP recorded an average flow of 1.0 mgd for Station 10 during the EPA survey. Sluice pits used for settling the ash slurry (from the steam plant) represent the only external waste treatment presently found in Area A. Waste loads being discharged to the South Fork of the Holston River approximated 240 lb/day suspended solids and 470 lb/day COD. Oil and grease values were negligible. The EPA survey results suggest that unreported waste sources may be contributing to this outfall.

## Raw Water Supply, Station 11

The raw water supply for Area A pumped from the South Fork of the Holston River, Station 11, was approximately 46.7 mgd, according to special HDC pitot tube studies that have been partially substantiated by EPA and USAEHA calculations. The incoming river water was reported to be of good quality with a BOD of 1.1 mg/l and with 22 mg/l of suspended solids. Nutrient levels were low with the exception of 1.0 mg/l of nitrite-nitrate, indicating some enrichment from upstream sources.

A summation of wastewater loads from Area A, for the period of the EPA survey, discloses that 20,300 lb/day BOD, and 4,060 lb/day of suspended solids were collectively being discharged to the South Fork of the Holston River. Included in the suspended solids load was 3,600 lb/day being contributed by ASG Industries to the upper section of the Main HAAP Outfall, although much of this load actually settled out in the open (ASG) ditch before reaching the main outfall. As mentioned previously in this report, the mean total volume of wastewater discharge from the overall HAAP Area A was 43.3 mgd. This figure excludes the flow contribution from Unnamed Creek and the ASG wastewaters.

Comparison of the 1972 EPA summary data to the 1971 USAEHA studies and the RAPP application data is as follows:

WASTEWATER VALUES - SUM OF ALL OUTFALLS*

| | USAEHA | RAPP | 1972 EPA |
|---|---|---|---|
| Flow (mgd) | 37.6 | 40.3 | 43.3 |
| BOD (lb/day) | 9,360 | 9,920 | 20,300 |
| COD (lb/day) | 13,200 | 25,500 | 19,100<br>(approximately) |
| SS (lb/day) | 6,060 | 68,000 | 4,060 |

By comparing the RAPP data to the EPA 1972 results, it is seen that only the flow values are in reasonable agreements. Differences between the 1972 results and the previous USAEHA data series are especially critical because the latter figures were supposed to provide specific engineering design criteria for upcoming HAAP A waste treatment processes. USAEHA loadings for BOD and COD are about one-half the 1972 EPA loads. Although many other questions concerning MUCOM's approach and the waste-abatement plans for HAAP remain unanswered, the differences expressed herein could alone greatly alter the expected performance of the planned aeration basins at HAAP A. Design specifications that apparently are being employed at the present time will fall far short of attaining effluent limitations predicated upon "best practicable control technology currently available."

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* Production levels have remained constant.

## F. FUTURE WASTE-ABATEMENT SCHEDULE

The HAAP pollution-abatement plans comprise part of the AMC Modernization Program, subject to Congressional appropriation. These projects under the Military Construction appropriations are expected to abate serious air and water pollution problems at military installations as addressed by Executive Order 11507. Furthermore, under the "Federal Water Pollution Control Act Amendments of 1972," Section 313, all Federal facilities having discharge or runoff of pollutants, are now instructed to comply with Federal, State, interstate and local requirements regarding control and abatement of pollution to the same extent that any "person" (as rigorously defined in the Act) is subject to the requirements of the Act.

Pertinent sections of the Act that would seem to have application to Federal facilities and Army munitions manufacturing plants are Sections 301 and 302 dealing with Best Practicable Control Technology required by 1 July 1977, and Best Available Technology required by 1 July 1983, both of which are directed to the national goal of eliminating the discharge of all pollutants. Additionally, Section 306 and 307 deal with standards of performance to be established through best available demonstrated control technology for new pollution sources and the establishment of toxic and pretreatment effluent standards, respectively.

However, under Section 313 of the Act, the President can exempt any Federal facility effluent source if it is in the paramount interest of the United States to do so: no such exemptions shall be granted in waiving requirements under Sections 306 and 307 of the Act. It is also stated that no such exemptions shall be granted because of a lack of appropriations, unless the President has specifically requested such appropriation as part of the budgetary process, and Congress has failed to make available such requested appropriation.

The November 1971 MUCOM report for HAAP specifically states that HAAP has a planned program for abatement of each of its major pollutants: the program is being implemented as rapidly as Federal funding permits. As of the end of 1971, the report cites that progress in planning has not been manifested in construction. It appeared doubtful that any significant construction would be accomplished prior to December 1972. We note the pilot aeration lagoon which is the first major item of construction at Area A, and which was scheduled for completion in December 1972, has not, at this date, been actually completed.

To gain the necessary background in understanding the envisioned pollution abatement plans at HAAP one must be aware of the preceeding and current criteria and standards under which these plans are being formulated. Earlier standards/criteria include the State of Tennessee air and water quality requirements and the CERL engineering design criteria. An Army report, *"Effluent and Ambient Air and Water Quality Standards and Regulations Applicable to Army Ammunition Plants"* has been recently completed, but copies have not yet been received. The most extensive and perhaps the most important set of criteria covering Army munitions manufacturing plants is that incorporated under the APSA Guidelines that give proposed air and water quality standards for both effluents and boundary conditions. These Guidelines are more complete and as limiting as any specific set of State or Federal standards, and according to the Army, can be applied universally across the entire MUCOM munitions manufacturing complex. MUCOM, in a recent Senior Scientist Steering Group Briefing of February 1973, compared future waste abatement performance expected at its various Government Owned-Company Operated (GOCO) facilities, specifically with the APSA load limits.

Based upon this understanding, the APSA Guidelines should be judged to be the controlling criteria for waste-abatement plans and activities at most Army munitions facilities. EPA Effluent Limitations for munitions manufacturing, if developed for purposes of Sections 301 and 304 of the Federal Water Pollution Control Act Amendments of 1972, will rely heavily upon the APSA Guidelines. The APSA Regulations are enumerated in this report [Table E-24] as are the MUCOM proposed schedules for identified pollution-abatement projects at HAAP, Area A [Table E-25]. No funds have been appropriated beyond Fiscal Year 1973. During the EPA survey, construction was in progress on a 4.5 million gal. pilot aerated lagoon (Phase I Pond) for HAAP A.

In the case of the Holston Army Ammunition Plant, the effluent limitations should be controlled by Water Quality Standards which call for a minimum DO content of 5 mg/l in both the South Fork and the Holston River. These limitations are shown in Table E-26.

Relative to the overall MUCOM pollution-abatement schedule for HAAP — based upon a preliminary analysis of the schedule, a number of potential deficiencies in the schedule are apparent [See the "remarks" column in Table E-25]. Additional information is necessary to ascertain,

## TABLE E-24

DEPARTMENT OF THE ARMY
AMMUNITION PROCUREMENT & SUPPLY AGENCY
PROPOSED GUIDELINES

APSA Regulation
Number 11-13

**Proposed Air Quality Standards**

### Design and Operating Standards (Proposed)

| Pollutant | Boundary Standard (ppm) | Stack Emission Standard (ppm) |
|---|---|---|
| Acidity | 12ug/$M^3$(1) | 50mg/$M^3$ |
| Ammonia | 0.15 | 100. |
| Carbon Monoxide | 0.15 | .... |
| Hydrocarbons | 0.20 | 200. |
| Hydrogen Sulfide | 0.02(5) | 100. |
| Lead | 0.5ug/$M^3$(4) | .... |
| Nitrogen Oxides (a) | 0.10(2) | 200. |
| Oxidants | 0.04 | .... |
| Ozone | 0.03 | .... |
| Particulates | 80ug/$M^3$(4) | 200mg/$M^3$* |
| Particulates, Incinerator | 80ug/$M^3$(4) | 450mg/$M^3$** |
| Sulfur Dioxide, Power Plant | 0.04(3) | 500 |
| Sulfur Dioxide, Acid Plant | 0.04(3) | 200 |

(1) Maximum value not to be exceeded more than 1% of the hours per year.
(2) Average value for measurable limits over a 1 hour period is not to be exceeded more than 1.0 percent of the time over a three month period.
(3) Maximum value not over 1% of the time in a 24-hour sample period.
(4) Maximum value for any 24-hour sample period.
(5) Average value for ½ hour not to be exceeded more than twice a year.

* This value is calculated from figure 1-1 of AR 11-21.
** This value is calculated from value given in paragraph 1-7C.(2) of AR 11-21.

(a) Nitrogen oxides include NO + $NO_2$.

## TABLE E-24 (Cont.)

APSA Regulation
Number 11-11

Proposed Water Quality Standards

Design and Operating Standards - Ionic Materials (Proposed)

| Pollutant | Effluent Standard ppm | Boundary Standard ppm |
|---|---|---|
| Aluminum | 1.0 | 0.1 |
| Ammonia | 0.1 | .01 |
| Antimony* | 0.05 | 0.01 |
| Arsenic* | 0.05 | 0.01 |
| Barium* | 1.0 | 0.1 |
| Beryllium | 0.05 | 0.01 |
| Bicarbonate | 35 | 35 |
| Bismuth* | 1.0 | 0.5 |
| Boron | 1.0 | 0.1 |
| Bromide | 1.0 | 0.5 |
| Calcium | 100 | 50 |
| Cadmium* | 0.01 | 0.01 |
| Chloride | 150 | 25 |
| Cesium | 1.0 | 0.1 |
| Chromate | 0.05 | 0.05 |
| Chromium | 1.0 | 0.1 |
| Cobalt* | 1.0 | 0.1 |
| Copper* | 0.2 | 0.02 |
| Cyanide | .025 | 0.01 |
| Floride | 1.0 | 0.7 |
| Germanium* | .5 | 0.05 |
| Iron | 0.3 | 0.05 |
| Lanthanum | 1.0 | 0.1 |
| Lead* | 0.05 | .01 |
| Lithium | 0.5 | 0.1 |
| Magnesium | 30 | 15 |
| Manganese* | 0.05 | 0.01 |
| Mercury | 0.01 | 0.01 |
| Molybdenum* | 1.0 | 0.1 |
| Nickel* | 1.0 | 0.1 |
| Nitrate | 5.0 | 0.5 |
| Phosphate | 0.5 | 0.05 |
| Platinum* | .5 | .05 |
| Potassium | 10 | 10 |
| Radioactivity, Total | ** | ** |
| Selenium | 0.01 | 0.01 |
| Silicon Oxide | 6 | 6 |
| Silver* | 0.05 | 0.01 |
| Sodium | 100 | 10-60 |
| Strontium* | 10 | .1 |
| Sulfate | 200 | 50 |
| Sulfite | 2.0 | 0.1 |
| Tantalum* | 1.0 | 0.1 |
| Tellurium | 0.1 | 0.1 |
| Thorium* | 1.0 | 0.1 |
| Tin* | 1.0 | 0.1 |
| Titanium* | 1.0 | 0.1 |
| Tungsten* | 1.0 | 0.1 |
| Uranium* | 1.0 | 0.1 |
| Vanadium* | 0.5 | 0.1 |
| Zinc | 0.5 | .05 |
| Zironium* | 1.0 | 0.1 |
| Total Heavy Metal | 5.0 | 5.0 |

* Heavy Metal

** Radioactive - gross beta activity in the known absence of Strontium 90 and alpha emitters not to exceed 1000 micromicrocuries per liter at any time. "Absence of" is defined as not more than 10 pico curies of Strontium 90 and 3 pico curies of alpha radiation

## TABLE E-24 (Cont.)

### Design and Operating Standards - Non Ionic Materials (Proposed)

| Pollutant | Effluent Standard ppm | Boundary Standard ppm |
|---|---|---|
| Color (Color Units)* | 3-30 | 3-30 |
| Maximum Temperature (°F) | a | 90 |
| Oil (ppm) | 15 | No Visible Oil on Water Surface |
| Oxygen Dissolved Minimum Value (ppm) | 5 | 5 |
| Biological Oxygen Demand (ppm) | 15.0 | 2.0 |
| Chemical Oxygen Demand (ppm) | 20.0 | 2.0 |
| Total Organic Carbon (ppm) | 30.0 | 3.0 |
| Phenols (ppb) | 10 | 10 |
| pH (pH Units) | 6.0-8.5 | 6.0-8.5 |
| Solids, Dissolved (ppm) | 500 | 200 |
| Solids, Suspended (ppm) | 25 | 25 |
| Insecticides Chlorinated Hydrocarbons (ppb) | 0 | 0 |
| Insecticides Organic Phosphorous (ppb) | 0.5 | 0.1 |
| Insecticides Carbamate (ppb) | 0.5 | 0.1 |
| Herbicides (ppb) | 0.1 | 0.1 |
| Bacteria-Monthly Average (No./100 ml)-% of samples (Coliform count) |  | (5000)-20<br>(2000)-5 |
| TNT and Nitrobodies (ppm) | 0.5 | 0.3 |

ppb - parts per billion
ppm - parts per million

a state water ambient temperature shall not be increased for more than 5°F, with the hourly temperature change of the state water not to exceed 1°F.

* color units are based on platinum-cobalt standard

### TABLE E-25

### PROPOSED POLLUTION-ABATEMENT SCHEDULE
### HAAP, AREA A - KINGSPORT, TENNESSEE[a]

| Item | Funding FY | Estimated Completion FY | Remarks |
|---|---|---|---|
| | | WATER | |
| Aerated Lagoon, Pilot Plant only (Phase I) | 70 | 72 | See comments on expected performance, this report but are presently not expected to meet water quality standards requirements |
| Aerated Lagoon, Full Scale (Phase II) | 73 | 76 | Design and performance criteria not known by EPA |
| Separation of uncontaminated cooling water from process waters | | | Specified in 1971 MUCOM report but no real followup evident in pollution abatement schedule |
| Tank-Farm Dike System | 72 | 74 | Spill Containment dikes with routing of spilled materials back to industrial wastewater treatment system (See other comments in this report.) |
| Water- and Air-Pollution Monitoring Systems | 73 | 75 | |
| Waterworks sludge settling and land disposal | 72 | 74 | Sludge to be disposed of onto Area B grounds. Because supernatants are designed to enter lagoon, full objectives will not be met until FY 76 |
| Boiler Blowdown to Aeration Lagoon | 72 | 74 | Lagoon will not be completed until FY 76, effectively causing delay in project objective until 76, rather than 74 |
| Pumphouse Trash Disposal | 72 | 74 | Further details sought |

### TABLE E-25 (Cont.)

### PROPOSED POLLUTION-ABATEMENT SCHEDULE
### HAAP, AREA A - KINGSPORT, TENNESSEE[a/]

| Item | Funding FY | Estimated Completion FY | Remarks |
|---|---|---|---|
| Replacement of distillation columns serving sludge-heater sludges in order to combat metals problem in effluents, Bldg. 2 | | | Plans not known |
| Ash pit waters, Bldg. 8 | 73 | 75 | Plans not known |
| Flash column improvements, Bldgs. 2 and 6, to improve propyl acetate recovery | 73 | 74 | Further details sought |
| Control and/or elimination of drainage from the tar tank area | | | Indicated as essential by EPA survey |
| Possible substitution of surface condenser in lieu of barometric condenser(s), Bldgs. 7 and 20 | | | Means of reducing water pollution |
| Alternative means of handling and disposing of ball mill and sludge-heater sludges | | | Likely a major waste source that should be handled and disposed of in slurry or semi-solids form |
| | | A I R | |
| Removal of methyl nitrate, and recovery of volatile gases from azeotropic stills, Bldgs. 2 and/or 6 | 73 | 76(?) | In feasibility stage only. Control for Bldg. 6 apparently unplanned |
| Precipitators for the Pulverized Coal Boiler (Area A?) | 70 | 73 | Further details sought |

TABLE E-25 (Cont.)

PROPOSED POLLUTION-ABATEMENT SCHEDULE
HAAP, AREA A - KINGSPORT, TENNESSEE[a/]

| Item | Funding FY | Estimated Completion FY | Remarks |
|---|---|---|---|
| Precipitators on Boilers (Not known if Area A and/or B) | 73 | 75 | Further details sought |
| Control and treatment of noxious vent gases from anydride manufacturing (Bldgs. 7 and 20) | | | Determined by Army as a major air-pollution source |
| Vents from producer gas building | | | Cited in USAEHA report |
| Vents from Bldg. 6, anhydride refining operations | | | Cited in USAEHA report |
| $NO_x$ control and treatment | | | Both $NO_x$ and $SO_x$ abatement technology being studied by MUCOM on an overall facilities basis. Prototype units now in development stage including molecular sieve for $NO_x$ which is fairly advanced. $NO_x$ and $SO_x$ problems considered reasonably critical. |
| $SO_x$ control and treatment | | | |
| SOLIDS[b/] | | | |
| Trash Disposal Incinerators (to serve bouth Areas A and B?) | 72 | 74 | Further details sought |

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[a/] Other items have been cited in MUCOM, USAEHA, and HAAP reports, but these items are either ambiguous or do not have a demonstrated impact on waste-abatement progress.

[b/] Open burning procedures for trash, debris, packaging materials spent process and explosives materials, etc. continue to represent current practices. Even though this report has not emphasized the problems of open burning and solid waste disposal, air pollution from open burning has been severe in many instances. Advanced technology is urgently needed.

## TABLE E-26

## STATE OF TENNESSEE EFFLUENT LIMITATIONS* FOR HAAP-AREAS A AND B

| Parameter | Effluent Limitations, lb/day |
|---|---|
| HAAP A | |
| BOD | 1,050 |
| HAAP B | |
| BOD | 1,430 |
| TKN | 76 |
| TN | 620 |
| $NH_3$ | 76 |
| $NO_3$ | 556 |

---

* These are effluent limitations required to maintain a DO of 5 mg/l in the South Fork and Holston Rivers.

step by step, planned activity to be undertaken by HAAP. Certain essential abatement items have not been either adequately described or incorporated into the plans or appropriated to date under the MUCOM schedule. Most importantly, no method seems available whereby the MUCOM technology implementation schedule could be translated into a concise statement as whether and when the effluent limitations can be met for the HAAP installation. Further coordination and detailed review of the HAAP waste abatement plans are needed between MUCOM, HAAP and the Region IV, EPA Enforcement and Federal Activities Program Offices.

There are two aspects of the HAAP biological treatment systems that pose serious concern about the success of this approach and that warrant much more attention. Past design criteria for the aeration lagoons have been liberal, and the effluent limits as specified will not meet the effluent limitations. The biological systems as now described to the EPA are not consistent with "best practicable control technology currently available." The other aspect deals with the kinds and amounts of wastes being treated and their inherent impact upon the efficiency of a biological system. If it is assumed that future HAAP A activities will almost necessarily include the strict segregation of cooling waters from process flows (the latter to receive treatment), then the (remaining) 0.6 to 4.0 mgd process wastewaters may be more adaptable to chemical/physical treatment than to biological treatment, as now being planned by HAAP.

Increased recycling, re-use, and recovery of process flows together with strict segregation of cooling waters could hold the total process wastewaters at Area A down to 1 mgd, or less. Available data strongly suggest that these process effluents per se, are extremely strong in COD, complex organics, toxicity, and, possibly, metals content. Unfortunately, proper data do not exist relative to the characteristics of individual process flows; this is partly because the cooling and process flows are now combined within the existing sewer system inside each manufacturing building. Based upon similar experiences and with the pieces of data now on hand, the implied risk in using biological treatment with the HAAP wastes is abnormally high. Mixing, with additional cooling water, and enlarging the size of the biological units are not likely to substantially improve the creditability and performance of the biological approach. Characterization of the separate process flows could serve to clarify this most important issue.

# E-IX. HOLSTON ARMY AMMUNITION PLANT-AREA B

## A. GENERAL

Area B, the nitric acid and explosives manufacturing facility, is situated on 6,370 acres immediately downstream of the confluence of the North and South Forks of the Holston River [Figure IV-1] and approximately 6 miles west of the City of Kingsport and Area A.

Major processes at Area B, include nitric acid and ammonium nitrate production; the preparation, manufacturing, and packaging of various explosives; and the recovery of waste acetic acid for shipment to Area A.

Area B was studied from 12 through 15 December 1972. Mr. Robert Banner, Jr., chemical engineer at HDC, provided information and assistance during the industrial surveys.

## B. UTILITIES AND WATER SUPPLY

Area B purchases its electricity and potable water (0.2 mgd) from the City of Kingsport. HAAP records show that about 84.4 mgd of water is pumped through an intake screen from the Holston River at two pumping stations. About 14.5 mgd of this is treated by flocculation, sedimentation, and filtration to produce process water; about 0.75 mgd of this is deionized for use as boiler-feed water.

Wastewaters discharged to the river totaled 84.6 mgd. A natural stream entering the plant grounds (Arnotts Branch) contributed 11.4 mgd, thus producing a net waste flow of 73.2 mgd.

Only one of the two water filtration plants was on stream at the time of the EPA survey. The wastewater from cleaning the intake screens, backwashing the filters, and desludging the sedimentation basins enters the river at Station 25. Pollution-abatement plans at the water treatment facility call for land disposal of material removed from the intake screens and for continuous sedimentation of filter backwash water with solids going to thickeners, followed by sand bed drying and ultimate disposal at a landfill. The sedimentation basins treating the main flow will be converted to continuous sludge removal. Sludge from these basins will also be thickened, dried on sand beds and disposal of at a landfill.

Wastewaters from the steam-production buildings consist of boiler blowdown; ion exchanger backwash, regeneration wastes, and rinse water; cinder decant water; condensate and cooling water. These wastes are discharged through the main outfall, at Station 33. Present abatement plans call for these wastes to be diverted to the industrial waste treatment facility.

Sanitary wastes from Area B and from a few homes in the immediate area are treated at a secondary treatment plant on the grounds, consisting of primary sedimentation, trickling filters, secondary sedimentation and chlorination. The adequately treated waste is discharged to the Holston River at Station 26.

## C. PROCESS OPERATIONS AND WASTE SOURCES

The main activities at Area B include production and concentration of nitric acid; production of ammonium nitrate: production, purification, and packaging of explosives; and the recovery of dilute acetic acid, which is then returned to Area A.

Nitric acid is produced by the oxidation of anhydrous ammonia to nitrogen oxide that, when dissolved in water, produces dilute nitric acid. It is concentrated to 99 percent by extractive distillation with magnesium nitrate. The process wastewaters from these operations include ammonia, nitric acid, the nitrite ion, and a small amount of oil from the compressors used in the ammonia oxidation process. These process wastes and the cooling water from the processes are discharged at Station 33 [Figure E-12].

The concentrated nitric acid is, together with anhydrous ammonia, employed in the production of a nitric acid-ammonium nitrate solution, an intermediate step in this manufacturing process. Essentially all of the waste flow from the operation is cooling water, low in contamination. It was included in Station No. 33.

Manufacture of the explosive compounds takes place in a series of facilities which receive glacial acetic acid (conveyed in tank cars) and acetic anhydride from Area A, nitric acid and the ammonium nitrate-nitric acid solution (conveyed in tank cars) from Area B, and other materials purchased for use. These materials include hexamine (hexamethylene tetramine), wax, TNT (trinitrotoluene), lacquer and several desensitizing agents.

In the "Preparation" complex [Figure E-13] a number of operations are carried out. Hexamine is dissolved in glacial acetic acid. The ammonium nitrate-nitric acid solution is stored for use elsewhere. Lacquer mixtures for use later in the process are also prepared. Waste flows from the Preparation complex include spilled hexamine and negligible amounts of acids and other organics. The wastes from these operations were monitored at Stations 28 and 33.

The hexamine-acetic acid solution is pumped to the "Nitration" operation where the hexamine solution is batch nitrated, with the nitric acid-ammonium nitrate solution, to produce crude RDX ($C_3H_6O_6N_6$) or HMX ($C_4H_8O_8N_8$). Acetic acid and acetic anhydride are also added to the reaction vessel. After initial reaction, the mixture is "aged" and then diluted with wastewater from a vent scrubber on the reaction vessel plus other water from a later washing operation. Contaminants in the explosive mixture at this point include acetic acid, ammonia, nitric acid, and numerous abphatic and cyclic nitro compounds. Contaminated waste streams from the nitration operation are routed through a catch basin in route to the industrial sewer. The waste flows from this operation include cooling water, condensate, agitator seal water, and floor and equipment washdown water. The contaminants include RDX, HMX, acetic acid, and other materials, mostly from leaks and spills in the nitration operation. The flows from the various nitration facilities were monitored at Stations 28, 29, 31 and 33.

The crude RDX or HMX slurry is pumped from "Nitration" to "Washing." Another source of crude explosive is the "B-line" (to be discussed later). In the washing operation, the explosive is filtered, washed, and reslurried for transfer to another series of processing areas. The filtrate and most of the water used to wash the explosive, at a 60 percent acid concentration, are sent to the "B-line" area for recovery of acetic acid and ammonia. The final dilute filtrate is sent to "Nitration" to be used

E-122a

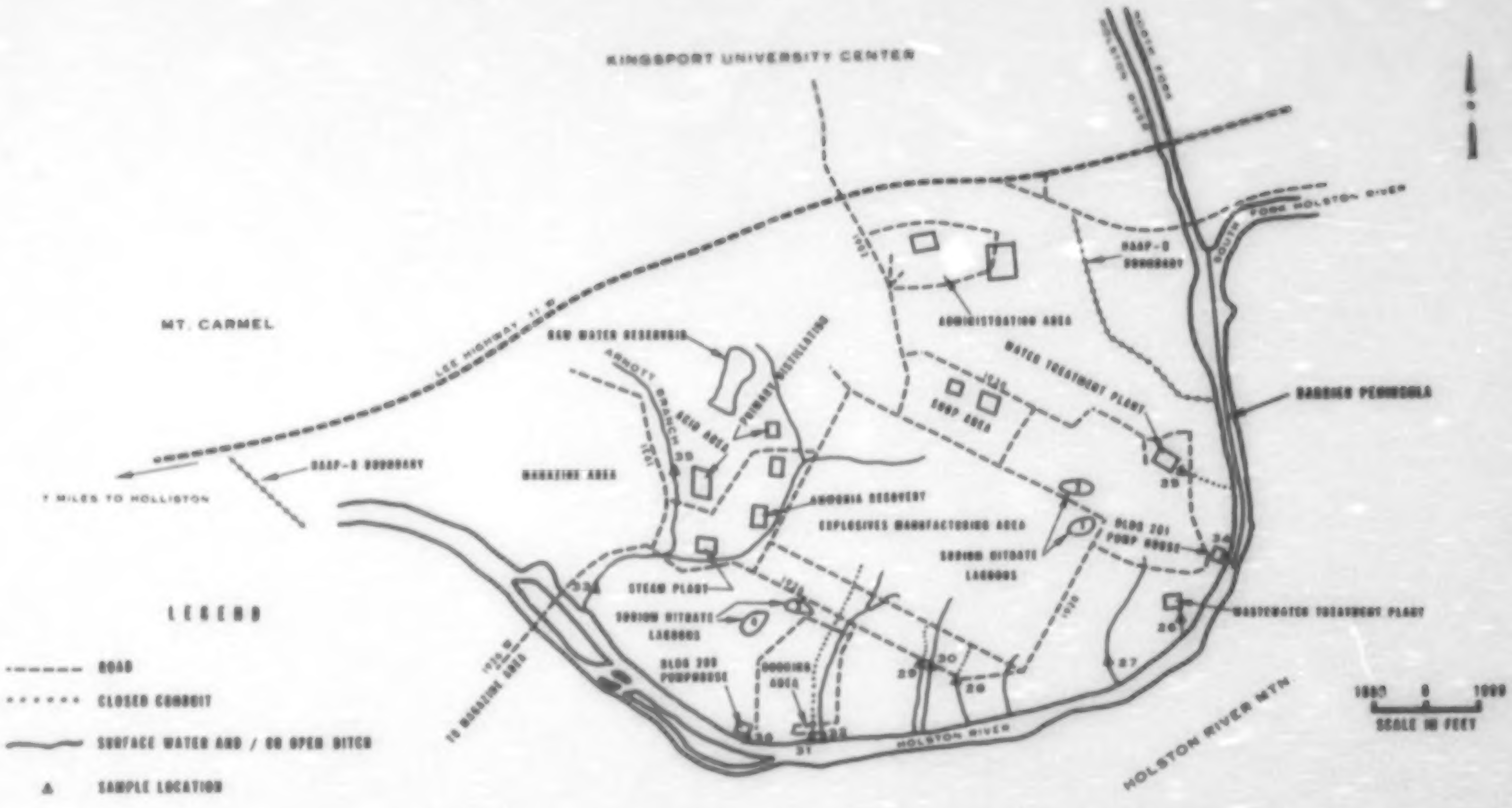
KINGSPORT UNIVERSITY CENTER
NORTH FORK HOLSTON RIVER
SOUTH FORK HOLSTON RIVER
HAAP-B BOUNDARY
ADMINISTRATION AREA
MT. CARMEL
LEE HIGHWAY 11 W
RAW WATER RESERVOIR
PRIMARY DISTILLATION
ARNOTT BRANCH
ACID AREA
WATER TREATMENT PLANT
SOAP AREA
BARGER PENINSULA
HAAP-B BOUNDARY
MAGAZINE AREA
7 MILES TO HOLLISTON
AMMONIA RECOVERY
EXPLOSIVES MANUFACTURING AREA
BLDG 201 PUMP HOUSE
SODIUM NITRATE LAGOONS
STEAM PLANT
SODIUM NITRATE LAGOONS
WASTEWATER TREATMENT PLANT
BLDG 205 PUMPHOUSE
DUMPING AREA
TO MAGAZINE AREA
HOLSTON RIVER
HOLSTON RIVER MTN
25
26
27
28
29
30
31
32
33
34
35
1000 0 1000
SCALE IN FEET
LEGEND
ROAD
CLOSED CONDUIT
SURFACE WATER AND / OR OPEN DITCH
▲ SAMPLE LOCATION

Figure E-12. Sampling Stations Holston Army Ammunition Plant - B

Kingsport, Tennessee

F-122b

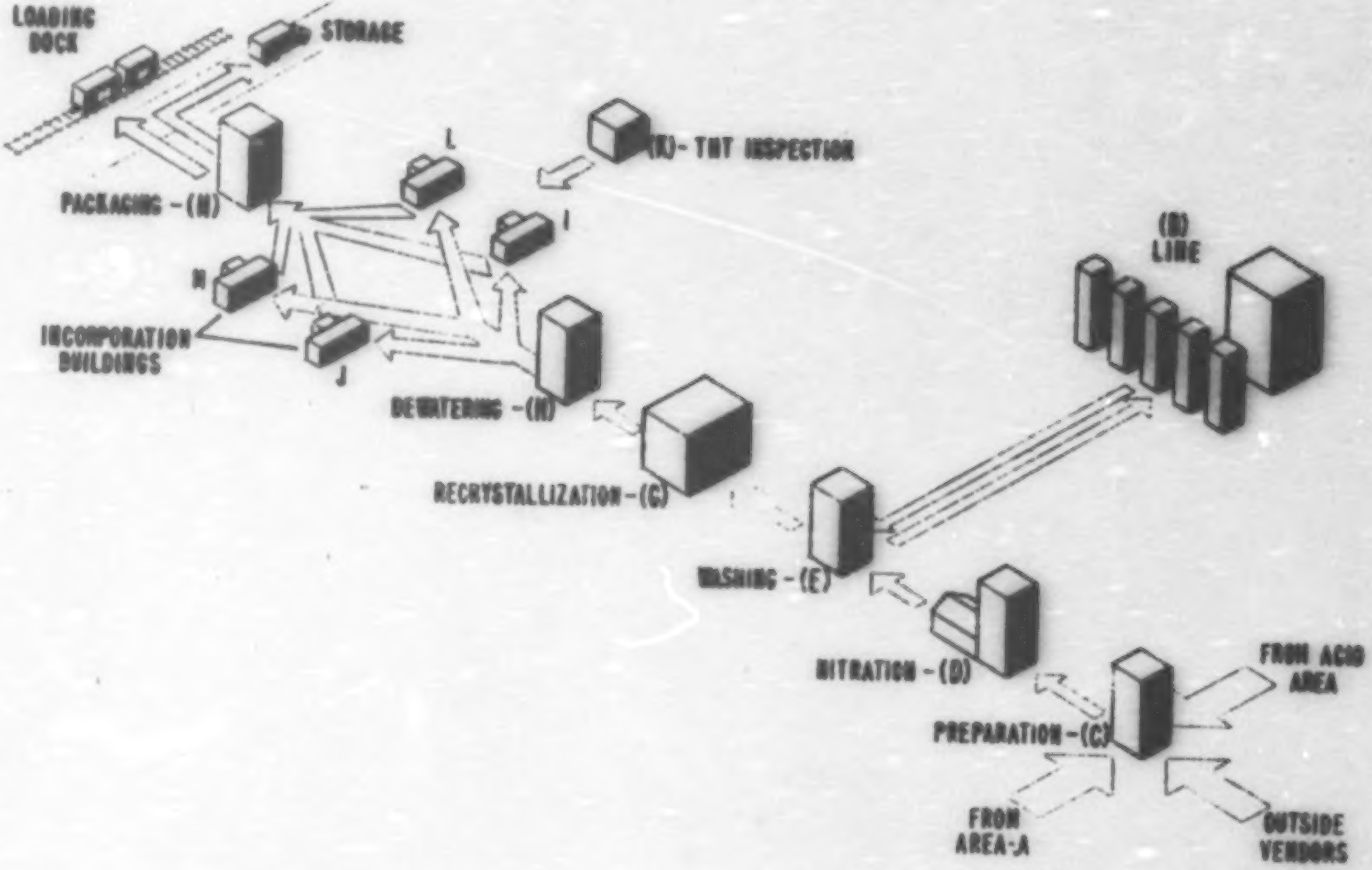
LOADING DOCK
STORAGE
(K)- TNT INSPECTION
PACKAGING -(M)
L
I
N
INCORPORATION BUILDINGS
J
DEWATERING -(H)
(B) LINE
RECRYSTALLIZATION -(G)
WASHING -(E)
NITRATION -(D)
FROM ACID AREA
PREPARATION -(C)
FROM AREA-A
OUTSIDE VENDORS

Figure E-13. SCHEMATIC OF EXPLOSIVE PRODUCTION LINE-AREA B, HOLSTON ARMY AMMUNITION PLANT

Courtesy of MTD, Picatinny Arsenal, Dover, N.J.
Taken from W. Heidelberger Report, Nov. 1971.

as dilution water. The washed explosive is reslurried and pumped to another complex for further processing. The contaminated wastes, containing explosives, acetic acid, nitric acid, and other components of the mixture, pass through baffled catch basins before entering the industrial sewer. They were sampled at Stations 28, 29, 31 and 33.

The washed explosive slurry is then pumped to the "Recrystallization" facilities, which, in addition to recrystallization, accomplish dewatering and compounding of special-purpose explosives. The slurry is pumped into dissolvers containing solvents. Depending upon the type of crystal desired in the explosive, the solvents used can be cyclohexanone, acetone, or toluene. After dissolution, the solvent is distilled off, condensed, and re-used. The batch is then cooled and either dewatered in the crystallization process or sent on as a slurry to the "Dewatering" operation. The wastewaters -- mostly cooling water, seal water, and condensate, were sampled at Stations 28, 29, 30, 31 and 32. The contaminated flows pass through baffled catch basins before being introduced to the sewers. The contaminants include solvents, explosives, lacquers, and other compounding agents.

The explosive slurry or dewatered explosive is then sent to "Dewatering" for grinding or dewatering and grinding. All grinding is done in a water slurry. In order to remove explosives, which are later sent to receiving tanks, the filtrate is settled, and the overflow water drains to a catch basin and then to the sewer. The ground, dewatered explosives (as a wet cake) are then sent to another series of facilities for compounding. The wastewaters, containing explosives, solvents, condensate, acetic acid, settling tank overflow, and wash water are sampled at Stations 28, 29 and 31.

Compounding of the final product is accomplished in the "Incorporation" process where RDX or HMX are mixed with melted TNT (the resultant water layer being severed) to form Composition B. This material is heated, wax is added, and then the mixture is solidified by passing it onto a cooled conveyor belt. In other operations in this series, the explosive in wet cake form is dried in kettles, perforated trays, or in drying ovens. In all cases the air used in drying is scrubbed with water before being discharged to the atmosphere. The wastewaters, containing explosives (including TNT), were sampled at Stations 28, 29 and 31.

In the TNT-receiving area, TNT is brought in by truck, unpackaged, and dumped into melt kettles for transportation to the "Incorporation" operation. Packaging of some compounded explosives is also carried out at these buildings. Explosive dusts are drawn to a wet scrubber for removal. The scrubber water and floor wash water flow to an industrial sewer through catch basins and were sampled at Stations 28 and 31.

The final step in explosives manufacturing occurs in the "Packaging" area. The explosives, received in barrels or carts, are packaged and loaded on trucks for shipment to local storage or to railroad loading docks. Dust is exhausted from the buildings and scrubbed with water. The scrubber water and floor and equipment washdown water were sampled at Stations 28, 29 and 31.

The 60-percent acetic acid solution from the "Washing" operation is sent to the "B-line" facilities for recovery of the acetic acid. The solution contains acetic acid, nitric acid, and a small amount of RDX and HMX. First the solution is neutralized with sodium hydroxide and sent to a primary evaporator. About 80 percent of the feed is volatilized, condensed, and recovered as 60 percent acetic acid. The remaining 20 percent is withdrawn from the bottom of the evaporator as a sludge. The sludge is diluted and heated to about 100°C. During cooling, an RDX slurry is added as seed to aid crystallization of the RDX-HMX. The crystallized explosives are returned to the "Washing" operation.

The remaining liquid is sent to a secondary evaporator that recovers more acetic acid. The sludge from the secondary evaporators is steam stripped to recover the remaining acetic acid. (All recovered acetic acid is sent to Area A for purification and concentration.) Sodium hydroxide is added to the stripped sludge. This converts the ammonium nitrate in the sludge to sodium nitrate and ammonia, the residual acetic acid to sodium acetate, and the residual RDX and HMX to ammonia and sodium nitrate. The ammonia released in the reactor is absorbed in water and sent to an ammonia recovery area. The sludge from the reactor is pumped to storage lagoons for storage until a fertilizer facility is constructed. The waste flows, containing acetic acid and a small amount of ammonia, were sampled at Station 33.

Aqueous ammonia from the "B-line" is distilled to recover anhydrous ammonia, which is used as fertilizer, for impurities in the recovered anhydrous ammonia prevent its further use in manufacturing of explosives. The major impurities in the column bottoms are methyl amine and dimethyl amine; these are sampled at Station 33.

## D. REFUSE ACT PERMIT APPLICATION (RAPP) DATA

In September 1971, the Holston Army Ammunition Plant submitted an application for a permit to discharge under the Refuse Act Permit Program [Table E-27]. This table also shows the total pollutant loads from the Army Environmental Hygiene Agency survey of March to June 1971, the EPA survey station numbers consistent with the RAPP codes, and totals from the EPA survey.

The RAPP data and EPA survey results for BOD and SS agree closely. However, ammonia loads do not agree. A critical consideration is that the total content of ammonia in the waste stream will determine whether or not a special ammona-removal process is necessary. It is recommended that the ammonia content of the waste streams be closely surveyed before designing the final treatment processes.

## E. DISCUSSION OF 1972 EPA FINDINGS

There were 12 sampling points at Area B [Figure E-12 and Table E-28]. Stations 25, 28, 29, 30, and 33 were manually sampled at two-hr intervals and composited on an equal-volume basis. Stations 26, 31, 32, 34, and 36 were sampled using a SERCO automatic sampler and composited on an equal-volume basis at the end of 24 hr. Grab samples were collected manually from stations 27 and 35 twice daily and combined to make one composite sample for each station. Temperature, pH, and conductivity were measured each time a manual sample was collected and at least three times per day at stations where automatic samplers were used. Samples for oil-and-grease analysis were 24-hr composites consisting of well-mixed grab samples collected every two hr (except for Station 31 which

## TABLE E-27

## OUTFALL CHARACTERISTICS FROM RAPP APPLICATION, HOLSTON ARMY AMMUNITION PLANT-AREA B
KINGSPORT, TENNESSEE

| RAPP Outfall Number | EPA Stn. No.[a] | Flow mgd | BOD | | COD | | SS | | $NH_3$-N | | TKN | | $NO_3$-N | | P-Total | | Mn | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | mg/l | lb/day | mg/l | lb/day | mg/l | lb/day | mg/l | lb/day | mg/l | lb/day | mg/l | lb/day | mg/l | lb/day | mg/l | lb/day |
| 001 | 25 | 1.0 | 36 | 304 | 455 | 3,790 | 1,653 | 13,774 | 1 | 9 | 3 | 26 | 1 | 11 | 1 | 4 | 2 | 17 |
| 002 | 26 | 0.1 | 5 | 4 | 23 | 19 | 4 | 3 | | | | | 7 | 6 | 6 | 5 | | |
| 003 | 27 | - - - - - - - - - - - - - - - SURFACE DRAINAGE ONLY - NO INFORMATION GIVEN - - - - - - - - - - - - - - - - - - - - - - - - - - | | | | | | | | | | | | | | | | |
| 004 | 28 | 1.2 | 70 | 726 | 180 | 1,796 | 18 | 183 | 4 | 36 | 4 | 40 | 10 | 104 | 1 | 8 | | |
| 005 | 29,30 | 38.0 | 21 | 6,500 | 61 | 19,175 | 51 | 16,142 | 3 | 854 | 3 | 1,076 | 1 | 325 | 0.5 | 127 | 0.5 | 149 |
| 006 | b/ | 0.0001 | | | | | | | | | | | | | | | | |
| 007 | 31,32 | 2.4 | 166 | 3,323 | 386 | 7,712 | 25 | 507 | 3 | 63 | 3 | 73 | 1 | 21 | 1 | 13 | | 5 |
| 008 | 33 | 54.7 | 13 | 5,903 | 30 | 13,623 | 25 | 11,407 | 3 | 1,536 | 3 | 1,689 | 2 | 835 | 1 | 456 | | — |
| TOTALS | | 97.4 | | 16,760 | | 46,115 | | 42.016 | | 2,468 | | 2,904 | | 1,352 | | 613 | | 171 |
| TOTALS FROM USAEHA REPORT[c] | | 77.1 | | <6,500 | | 22,250 | | 9,760 | | 802 | | 1,120 | | 1,670 | | <250 | | |
| TOTALS FROM EPA SURVEY | | 84.6 | | 14,750 | | | | 31,493 | | 102 | | <600 | | 2,482 | | 86 | | |

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a/ These station numbers refer to the 1972 study.

b/ This outfall was not sampled.

c/ This refers to the U.S. Army Environmental Hygiene Agency Report, 19 March - 28 June 1971.

## TABLE E-28

## DESCRIPTION OF EPA SAMPLING STATIONS, HAAP, AREA B
KINGSPORT, TENNESSEE
EPA SURVEY OF 12 THROUGH 15 DECEMBER 1972

| Survey Station Number | Refuse Act Permit Discharge Number | Type of Sample | Station Location |
|---|---|---|---|
| 25 | 001 | Composite | Filter plant backwash, at manhole adjacent to perimeter road |
| 26 | 002 | Composite | Sewage treatment plant effluent, prior to chlorination |
| 27 | 003 | Grab | Surface water drainage from production lines 9 and 10, at open ditch adjacent to perimeter road |
| 28 | 004 | Composite | Process wastes at sewer outfall, adjacent to perimeter road |
| 29[a] | 005 | Composite | Process wastes and cooling water at outfall, adjacent to perimeter road |
| 30[a] | 005 | Composite | Cooling and surface waters from production lines 6 and 7, at sewer outfall adjacent to perimeter road |
| 31[a] | 007 | Composite | Process wastes from production lines 3, 4, and 5, at sewer outfall adjacent to perimeter road |
| 32[a] | 007 | Composite | Cooling water from production lines 3, 4, and 5, at sewer outfall adjacent to perimeter road |
| 33 | 008 | Composite | Main outfall ditch, at HAAP effluent water quality monitor station |
| 34 |  | Composite | Raw-water intake at Building 201 pumphouse |
| 35 |  | Grab | Arnotts Branch, upstream of nitric-acid production area |
| 36 |  | Composite | Raw-water intake at Building 209 pumphouse |

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[a] Flows at Stations 29 and 30 mixed together before entering the river. The same is true of flows at Stations 31 and 32.

was a composite of three equal volume grab samples taken over a 4 to 6 hr period).

Flow measurements were made at the following stations:

1. Measurements carried out at Stations 25 and 31 were made on instantaneous flows at two-hr intervals with a Marsh-McBirney electromagnetic water current meter. With the flow at Station 31 only being measured for 24 hr because the high river stage surcharged the outfall pipe;
2. Flows measured at Stations 26 and 27 were obtained using V-notch weirs and flow recorders;
3. The waste streams at Stations 28, 29, 30, 32, 33, and 35 were gaged several times daily during the study period, and a rating curve was established.

The flows at the remaining stations were extracted from HAAP records. The flows and analytical data obtained have been tabulated [Table E-29].

The BOD of the raw water entering the plant was, from Arnotts Branch, 100 lb/day and, from the water in the Holston River, 4,130 lb/day. For suspended solids the load from Arnotts Branch was 4,400 lb/day and in the intake from the Holston River, 32,570 lb/day. The total BOD leaving the plant was 14,750 lb/day and the total suspended-solids content was 31,493 lb/day.

Therefore, the net contribution of the plant was about 10,000 lb BOD/day. The streams leaving the plant had about 5,000 lb of suspended solids/day less than the entering streams. This net loss of suspended solids cannot be explained on the basis of the information available.

### TABLE E-29

### SUMMARY OF FIELD MEASUREMENTS AND CHEMICAL DATA
### HOLSTON ARMY AMMUNITION PLANT-AREA B
### KINGSPORT, TENNESSEE

### 13-15 DECEMBER 1972

| Station Number | 25 | | 26 | | 27 | | 28 | |
|---|---|---|---|---|---|---|---|---|
| Station Description[a] | Filter Plant Backwash (RM 141.6) | | Sewage Treatment Plant Effluent (RM 140.7) | | Surface Water Drainage (RM 140.3) | | Process Wastewaters (RM 139.7) | |
| Parameter[b] | Range | Average | Range | Average | Range | Average | Range | Average |
| Flow (mgd) | 0.66-1.62 | 1.1 | 0.66-0.71 | 0.69 | 1.21-1.42 | 1.3 | 0.59-0.80 | 0.70 |
| pH (standard units), range | 6.5-7.9 | | 7.5-8.5 | | 6.6-7.1 | | 3.2-7.9 | |
| Temperature (°C), range | 11.0-14.5 | | 13.0-15.0 | | 10.5-10.5 | | 17.0-25.0 | |
| Conductivity (µmhos/cm), range | 300-850 | | 420-500 | | 220-280 | | 260-800 | |
| BOD | 1.2-2.7 | 1.9 | 4.4-8.2 | 6.9 | 2.7-3.5 | 3.2 | 48->160 | > 94 |
| BOD (lb/day) | | 16 | | 39 | | 35 | | 550 |
| COD | | | | | | | 41-407 | 224 |
| TOC | 5-6 | 5.6 | 7-8 | 7.3 | 5-9 | 6.6 | 12-115 | 47 |
| Total Solids | 313-441 | 369 | 314-335 | 324 | 161-176 | 167 | 249-350 | 269 |
| Suspended Solids | 7-36 | 21 | 2-15 | 8 | 12-42 | 22 | 11-80 | 34 |
| Suspended Solids (lb/day) | | 160 | | 43 | | 240 | | 220 |
| Total Kjeldahl Nitrogen-N | N.D.[c] | | 0.9-1.1 | 1.0 | 0.6-1.0 | 0.77 | 8.8-35 | 17.6 |
| Total Kjeldahl Nitrogen-N (lb/day) | | | | 5.70 | | | | 106 |
| $NH_3$-N | N.D. | | < 0.5-0.6 | < 0.5 | N.D. | | 6.5-26 | 13.1 |
| $NH_3$-N (lb/day) | | | | < 2 | | | | 78.8 |
| $NO_2^- + NO_3^-$-N | 0.6-3.1 | 1.6 | 3.6-4.0 | 3.8 | 1.5-1.6 | 1.5 | 1.5-5.4 | 3.1 |
| $NO_2^- + NO_3^-$-N (lb/day) | | 13.3 | | 21.5 | | 16.6 | | 180 |
| Total Phosphorus-P | 0.04-0.07 | 0.05 | 0.45-0.49 | 0.47 | 0.06-0.07 | 0.07 | 0.02-5.9 | 2.0 |
| Total Phosphorus-P (lb/day) | | | | | | | | 13.2 |
| Oil and Grease | | | | | | | 1-23 | 10 |
| Manganese | 0.3-0.5 | 0.4 | | | | | | |

### TABLE E-29 (Cont.)

### SUMMARY OF FIELD MEASUREMENTS AND CHEMICAL DATA
### HOLSTON ARMY AMMUNITION PLANT-AREA B
### KINGSPORT, TENNESSEE

### 13-15 DECEMBER 1972

| Station Number | 29 | | 30 | | 31 | | 32 | |
|---|---|---|---|---|---|---|---|---|
| Station Description[a/] | Process Wastewaters (RM 139.6) | | Cooling and Surface Waters (RM 139.6) | | Process Wastewaters (RM 139.2) | | Cooling and Surface Waters (RM 139.2) | |
| Parameter[b/] | Range | Average | Range | Average | Range | Average | Range | Average |
| Flow (mgd) | 3.02-3.97 | 3.54 | 11.5-14.4 | 13.2 | 2.1-2.5 | 2.3 | 8.22-9.11 | 8.8 |
| pH (standard units), range | 4.1-6.8 | | 6.8-8.4 | | 6.5-7.3 | | 6.5-7.7 | |
| Temperature (°C), range | 20.0-22.5 | | 15.0-19.0 | | 15.0-18.0 | | 12.5-15.5 | |
| Conductivity (µmhos/cm), range | 260-380 | | 200-340 | | 230-340 | | 210-260 | |
| BOD | 150-240 | 193 | 7.6-13 | 10.2 | 110-350 | 213 | 9.5-14.0 | 12 |
| BOD (lb/day) | | 5680 | | 1101 | | 4090 | | 840 |
| COD | 42-235 | 175 | | | 69-151 | 97 | | |
| TOC | 24-56 | 44.2 | 4-8 | 6.3 | 24-38 | 28.7 | 8-10 | 8.7 |
| Total Solids | 197-231 | 217 | 156-199 | 180 | 180-228 | 203 | 218-246 | 232 |
| Suspended Solids | 10-20 | 15 | 32-41 | 36 | 6-11 | 8 | 67-96 | 79 |
| Suspended Solids (lb/day) | | 440 | | 3940 | | 150 | | 5800 |
| Total Kjeldahl Nitrogen-N | 1.0-7.1 | 3.95 | 0.6-0.7 | 0.6 | 0.9-1.6 | 1.2 | 0.6-0.8 | 0.73 |
| Total Kjeldahl Nitrogen-N (lb/day) | | 120 | | 70.1 | | 24 | | 53.5 |
| $NH_3$-N | < 0.5-2.0 | 0.8 | N.D.[c/] | | N.D. | | N.D. | |
| $NH_3$-N (lb/day) | | 24.3 | | | | | | |
| $NO_2 + NO_3$ -N | 3.9-8.8 | 5.9 | 1.2-3.6 | 2.0 | 2.1-2.7 | 2.4 | 0.9-1.0 | 1.0 |
| $NO_2 + NO_3$ -N (lb/day) | | 170 | | 212 | | 47 | | 70.4 |
| Total Phosphorus-P | 0.02-0.04 | 0.03 | 0.10-0.14 | 0.11 | 0.03-0.06 | 0.04 | 0.16-0.18 | 0.17 |
| Total Phosphorus-P (lb/day) | | | | 12.7 | | | | 12.4 |
| Oil and Grease | 4-10 | 7 | | | 5-23 | 11 | | |
| Manganese | 0.1-0.2 | 0.15 | 0.3[d/] | 0.3 | | | | |

TABLE E-29 (Cont.)

SUMMARY OF FIELD MEASUREMENTS AND CHEMICAL DATA
HOLSTON ARMY AMMUNITION PLANT-AREA B
KINGSPORT, TENNESSEE

13-15 DECEMBER 1972

| Station Number | 33 | | 34 | | 35 | | 36 | |
|---|---|---|---|---|---|---|---|---|
| Station Description[a] | Main Outfall Ditch (RM 137.9) | | Intake Building 201 (RM 141.1) | | Arnott Branch (RM 137.9/0.8) | | Intake Building 209 (RM 139.0) | |
| Parameter[b] | Range | Average | Range | Average | Range | Average | Range | Average |
| Flow (mgd) | 46.7-58.8 | 53.0 | | 29[e] | 9.87-12.9 | 11.4 | | 55.4[e] |
| pH (standard units), range | 6.5-7.8 | | 6.8-7.8 | | 7.2-7.4 | | 7.2-7.9 | |
| Temperature (°C), range | 14.0-17.0 | | 10.0-12.5 | | 11.5-12.0 | | 10.5-11.0 | |
| Conductivity (umhos/cm), range | 270-520 | | 200-360 | | 320-360 | | 210-290 | |
| BOD | 3.5-7.4 | 5.5 | 1.4-2.8 | 2.2 | 0.4-2.0 | 1.1 | 6.9-8.7 | 7.8 |
| BOD (lb/day) | | 2400 | | | | 100 | | |
| TOC | 5-6 | 5.7 | 4[d] | 4 | 4-10 | 6 | 7[d] | 7 |
| Total Solids | 215-287 | 255 | 162-199 | 178 | 229-402 | 295 | 205-229 | 218 |
| Suspended Solids | 22-65 | 47 | 22-25 | 24 | 32-54 | 43 | 52-62 | 58 |
| Suspended Solids (lb/day) | | 20,500 | | | | 4400 | | |
| Total Kjeldahl Nitrogen-N | < 0.5-0.5 | < 0.5 | < 0.5-0.6 | 0.5 | N.D.[c] | | < 0.5-0.5 | < 0.5 |
| Total Kjeldahl Nitrogen-N (lb/day) | | <221 | | | | | | |
| $NH_3$ - N | N.D. | | N.D. | | N.D. | | N.D. | |
| $NO_2$ + $NO_3$-N | 3.2-5.8 | 4.3 | 0.9-1.7 | 1.2 | 1.2-1.6 | 1.4 | 1.1-1.9 | 1.5 |
| $NO_2$ + $NO_3$-N | | 1920 | | | | 137 | | |
| Total Phosphorus-P | 0.09-0.10 | 0.10 | 0.09-0.10 | 0.10 | 0.03-0.20 | 0.09 | 0.08-0.12 | 0.10 |
| Total Phosphorus-P (lb/day) | | 42.7 | | | | 8.26 | | |
| Oil and Grease | < 1-2 | < 1.0 | | | < 1-5 | 2 | | |
| Manganese | 0.08-0.1 | 0.09 | 0.2-0.3 | 0.2 | | | 0.1[d] | 0.1 |

[a] See Table 7 for Station Description.

[b] All values reported as mg/l, except where otherwise specified.

[c] N.D. - None Detected.

[d] All values are the same.

[e] This value was obtained from HAAP records.

It seems likely that the BOD reading (14,750 lb/day) is not representative of total organic content because of the presence of complex organic materials that may not exert an oxygen demand. The TOC leaving the plant totaled only about 6,100 lb/day. (Very few, if any, organic materials are resistant to the TOC analysis.) The presence of suspended solids may have made the TOC readings low in that, possibly, a representative sample was not introduced into the TOC analyzer.

Only about 100 lb/day of ammonia were in the effluent streams, but almost 2,500 lb/day of oxidized nitrogen ($NO_2$ and $NO_3$) are released to the river, and this should be reduced before being discharged.

Complex organic analyses were performed on samples collected from Stations 28 and 29 with a combined flow of 4.24 mgd. These waste discharges result from the explosives manufacturing phase of the HAAP Area B process [Table E-28]. Samples were also collected from Stations 31 and 33 and analyzed for complex organics. These waste discharges had a combined flow of 55.3 mgd and resulted from process effluents from production lines 3, 4 and 5, as well as the Main Outfall [Table E-28]. The analyses were conducted on an equal aliquot from the listed outfalls.

Compounds isolated are listed in Table E-30. The quantities of trinitrotoluene (TNT) and cyclohexanone discharged by the Holston Army Ammunition Plant, Area B, represent a serious hazard to aquatic life in the receiving waters of the Holston River. The amount of cyclohexanone discharged from Stations 28 and 29 ranged between 15.3 lb/day and 76.9 lb/day. The quantity of TNT in this discharge was between 9.1 lb/day and 46 lb/day. The amount of cyclohexanone discharged in the effluents

## TABLE E-30

## ORGANIC POLLUTANTS IDENTIFIED
## HOLSTON ARMY AMMUNITION PLANT-AREA B
## DECEMBER 1972

| Sample Stations | Compound | Concentration (mg/l) |
|---|---|---|
| 28 and 29 | cyclohexanone | 1.30 |
| | 2,4,6-trinitrotoluene | 0.78 |
| | 2-cyclohexylcyclohexanone | 0.02* |
| 31 and 33 | cyclohexanone | 1.40 |
| | 2-nonanone | 0.02* |
| | di-*n*-butylketone | 0.005* |
| | 2,2-dimethyloctanol | 0.005* |
| | 1,11-dodecadiene | 0.005* |
| | 2 or 4-sec-butylcyclohexanol | 0.030* |
| | phthalic acid esters (unidentified) | 0.50* |
| | 3,6-dimethyl-6-isopropyl-2-cyclohexanone | 0.015* |
| | 2-cyclohexylcyclohexanone | 0.010* |

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* Estimated - Standard not available for confirmation.

from Stations 31 and 33 ranged between 54 lb/day and 1,240 lb/day. These quantities are likely to result in adverse effects of a chronic nature through continuous exposure of aquatic life.

Static bioassay studies on streams 29 and 30 after mixing, but prior to entering the river, had a 96-hr $TL_m$ value of 23 percent. The combined flow was 16.72 mgd. A factor 1/20 was employed to obtain a river flow that would dilute this so that there would be no long-term impact on aquatic life. A bioassay on stream 31 (at 2.3 mgd) also indicated a 96-hour $TL_m$ of 23 percent. Similar calculations were performed on this flow. The summation of the two bioassay calculations disclosed that a minimum flow of 2,600 cfs would have to be maintained in the river to ensure no long-term impact on aquatic life from toxic effects. This figure does not include dilution water that would be necessary to protect the aquatic life from wastewater discharges at Area A or from other sources in the area.

## F. FUTURE WASTE ABATEMENT SCHEDULE

The Federal Water Pollution Control Act Amendments of 1972 and Executive Order 11507 apply to Area B as well as to Area A. [See discussion of the Act in Appendix E-VIII.]

MUCOM has proposed schedules for identified pollution abatement projects at HAAP, Area B [Table E-31]. No funds have been appropriated beyond Fiscal Year 1973. During the EPA survey, no construction had been started for Area B pollution control facilities.

Relative to the overall MUCOM pollution-abatement schedule -- based

## TABLE E-31

## PROPOSED POLLUTION-ABATEMENT SCHEDULE[a/]
## HAAP, AREA B - KINGSPORT, TENNESSEE

| Item | Funding FY | Estimated Completion FY | Remarks |
|---|---|---|---|
| | | WATER | |
| Boiler blowdown Bldgs. 200, 222 treatment to aerated lagoon | 72 | 74 | Design criteria complete. Architect-Engineer evaluating design criteria. |
| Filter-plant sludge | 72 | 74 | Design complete. Design and performance criteria not known by EPA. Includes 7-acre drying bed. |
| Process-area dike system | 72 | 74 | Contract let and contractor working 10/72. Includes 2 spill containment ponds. Effluent from these ponds to be returned to Area B treatment system. |
| Pumphouse trash removal | 72 | | Solids removed and sent to incinerator. |
| Industrial waste treatment - aerated lagoon | 72 | 76 | Design completed. Contract being negotiated with Clark-Dietz. Design criteria as specified by CERL not satisfactory. APSA guidelines should be used as design criteria. |
| Total segregation of uncontaminated cooling water from process water | | | Specified in 1971 MUCOM Report but no real follow up in pollution abatement schedules. |
| Remove sodium nitrate from holding ponds and replace sodium nitrate process units | | | Plans unknown |
| Water and Air Pollution Monitoring System | 73 | 75 | |
| Ammonia-rich waste streams should be subjected to ammonia stripping | | | Plans unknown |

## TABLE E-31 (Cont.)

### PROPOSED POLLUTION-ABATEMENT SCHEDULE[a]
### HAAP, AREA B - KINGSPORT, TENNESSEE

| Item | Funding FY | Estimated Completion FY | Remarks |
|---|---|---|---|
| | | A I R | |
| Electrostatic precipitators on pulverized coal boilers | 72 | 73 | No details |
| Ammonia oxidation Dupont AOP units | 72 | 75 | Pilot test using molecular sieve on AOP unit to remove $NO_x$ from air. |
| Magnesium concentration units (MAGGIE units) | | | Deferred to October 1975. No details on design. |
| $NO_x$ Control and Treatment | | | Both $NO_x$ and $SO_x$ abatement technology being studied by MUCOM on an overall facilities basis. Prototype units now in development stage including molecular sieve for $NO_x$ which is fairly advanced. $NO_x$ and $SO_x$ problems considered reasonably critical |
| $SO_x$ Control and Treatment | | | |
| | | S O L I D S[b] | |
| Refuse disposal incinerator - nonexplosive | 72 | 74 | Completion date October 1973. Twenty ton/day |
| Explosives incinerators | 73 | 76 | Two incinerators: a 2 ton/day and an 11 ton/day These three incinerators should eliminate all open-pit burning. |

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[a] Other items have been cited in MUCOM, USAEHA and HAAP reports, but these items are either ambiguous or do not have a demonstrated impact on water-abatement progress.

[b] Open burning procedures for trash, debris, packaging materials spent process, and explosives materials, etc. continue to represent current practices. Even though this report has not emphasized the problems of open burning and solid-waste disposal, air pollution from open burning has been severe in many instances. Advanced technology is urgently needed.

upon a preliminary analysis of the schedule, a number of potential deficiencies are apparent [mentioned in the "remarks" column in Table E-31].

Water Pollution

On the basis of a survey by the Army Environmental Hygiene Agency, the Army Construction Engineering Research Laboratory (CERL) provided recommendations and design criteria for pollution-control facilities at Area B. These recommendations included:

1. The water treatment plant settlers should be revised to permit continuous sludge removal, with the sludge being thickened and spread on sand beds for dewatering to approximately 20-percent solids and then disposed of in sanitary landfill.
2. All non-contaminated cooling-water streams should be separated from process waste streams and discharged directly to the river.
3. Ammonia-rich waste streams should be treated at the source by ammonia stripping to reduce the ammonia content prior to introduction to the industrial waste treatment system.
4. The combined industrial wastes, with phosphate added as a nutrient, should be treated in aerated lagoons with a minimum of 15 hr aeration, and the mixed liquor should be settled and the settler effluent discharged to the river with waste sludges being stabilized by aerobic digestion and ultimately disposed of by land spreading.

Standards established by the State of Tennessee were used by CERL as the basis for the design of the waste-treatment facilities. These standards require maximum effluent limitations of 450 mg/1 BOD and

180 mg/l suspended solids. The Army Ammunition Procurement and Supply Agency has proposed standards (APSAR 11-11) requiring a maximum BOD of 15 mg/l and a suspended solids content not to exceed 25 mg/l. The maximum ammonia content was set at 0.1 mg/l and nitrate at 5 mg/l. The maximum TNT and nitrobodies content was set at 0.5 mg/l. The total heavy-metals content was set at 5.0 mg/l (max).

CERL has conducted treatability studies on selected effluents from the Holston Army Ammunition Plant explosives-manufacturing area. Using acclimated organisms, the Laboratory found that the wastes were not toxic to organisms and were, therefore, treatable by a biological process. Because of the complex and toxic organic materials present it is questionable whether a biomass can be kept viable under these conditions. If the biomass does survive, it is most unlikely that it will degrade complex organic materials such as RDX, HMX, TNT, and cyclohexanone.

It is recommended that HAAP proceed immediately with separation of non-contaminated cooling water from the process-waste streams. If the resultant process-waste stream is compatible with biological treatment, this should be the first stage in the treatment system. If biological treatment is not applicable, the first stage could consist of chemical coagulation followed by flocculation and sedimentation. Either process should be designed to give a product with a suspended-solids content of 30 mg/l or less.

Regardless of whether the first stage treatment is biological or chemical in nature, a second stage, possibly consisting of adsorption on activated carbon or oxidation with ozone, will be necessary. Because of the explosive nature of some of the contaminants, thermal regeneration of the carbon may not be feasible, and ozonation would be the process of choice. This second-stage treatment is necessary, even after biological oxidation, to remove the complex organic materials that, in many cases, are extremely toxic substances.

If the concentrated waste stream is not amenable to biological oxidation, and if the first two stages consist of chemical treatment and carbon adsorption, it is likely that acetic acid and any other low molecular weight organic materials will not be adsorbed on the carbon or, at best, will be adsorbed to only a slight degree. If the ratio of low-molecular-weight organic materials to the nitrate ion is not too high, these materials will be removed in the denitrification process (discussed in the next paragraph). If the low-molecular-weight organic materials are in excess of that needed for dentrification, an aerobic biological-treatment process should be carried out after carbon adsorption.

Because of the high concentration of nitrate ions in the wastewater, even after the first and second stages, a nitrogen-removal step will be necessary to reduce the high algae growth potential of the receiving stream. Because all of the nitrogen will be in the oxidized state, a biological denitrification process is the logical step for this stage. It is conventional to use methanol as a substrate for this process but, in this case, it could be less expensive and more convenient to use acetic acid as the substrate. It could also be necessary to add phosphate ion to the denitrification reactor.

The final effluent from this series of operations will be low in oxygen demand, suspended solids, and nitrogen forms and will not pose a pollution threat to the Holston River.

Air Pollution

There are four main sources of air pollution in Area B. These are:

1. Nitric-acid producers;
2. Nitric-acid concentration;
3. Open burning of trash; and
4. Steam production.

The nitric-acid producers, at full capacity, release about 17,000 lb of $NO_x$/day to the atmosphere. The level of $NO_x$ in the general area is greater than 5 ppm, the maximum level recommended for personnel.

The nitric-acid concentrators, at full production, contribute about 5,200 lb of $NO_x$/day.

About 13 tons of refuse and explosive wastes are burned each day by open burning techniques. It is estimated that this operation adds 1,410 lb of contaminants to the atmosphere each day.

The six coal-fired and the three natural-gas or oil-fired boilers release about 25,000 lb of particulates and 11,000 lb of sulfur oxides to the atmosphere each day.

Refuse disposal is to be handled by sanitary landfill or by incineration with wet scrubbing of the stack gas. Design criteria are available for an explosives incinerator.

Consideration is being given to the use of electrostatic precipitators or wet scrubbers to remove particulate matter from the boiler-building stack gas.

The control of $SO_x$ and $NO_x$ from the incinerators and steam generators has not been given much consideration. Use of low-sulfur coal may solve the $SO_x$ problem, and $NO_x$ can be reduced by control of combustion temperatures, by catalytic reducers, or by molecular sieves.

Little consideration has been given to the volatile organic wastes released to the atmosphere from the various manufacturing operations in Area B. Those materials include cyclohexanone, toluene, acetone, acetic acid, and methyl nitrate, a by-product of the nitration operation. Studies should be undertaken to determine the extent of pollution from these sources and, as required, control measures should be developed and installed.

In all pollution-control operations, care should be taken to assure that the pollution is not transferred from water to the atmosphere or vice versa.

F-1

# APPENDIX F

## CITY OF KINGSPORT, TENNESSEE
## INDUSTRIAL WASTE ORDINANCE NO. 1539

# ORDINANCE NO. 1539

An ordinance regulating the use of public and private sewers in the City of Kingsport, Tennessee, providing for treatment of domestic sewage and the discharge of waters and such industrial wastes into the public sewers, as may be permitted hereby and repeal all ordinances or parts of ordinances in conflict with the provisions of this ordinance, and to fix a penalty for the violation thereof.

BE IT ORDAINED BY THE CITY OF KINGSPORT, AS FOLLOWS:

## Article I

Section 1. The general purposes of this ordinance are:

(a) To establish control of the contribution of domestic sewage, industrial wastes, or other wastes which may be permitted to be discharged into the public sewers or into any natural outlet within the jurisdiction of the City of Kingsport.

(b) To prohibit the contribution of sewage or industrial waste to the public sewers which may cause undue maintenance or operational difficulties in the sewage works.

(c) To prohibit the discharge into public sewers of all wastes which contain sufficient polluting material as may create a hazard to humans or animals and/or as may be deemed now or in the future undue pollution to the receiving streams.

(d) To provide by special agreement with the City for the discharge of wastes to the public sewers which are subject to a sewer service charge. In general, the sewer service charge will be based on excessive treatment cost and the origin of waters carrying waste from sources other than the public water supply.

Section 2. Unless the context specifically indicates otherwise, the meaning of the terms in this ordinance shall be as follows:

(a) "City" shall mean the City of Kingsport, Tennessee, or an authorized agent or agents acting for the City of Kingsport.

(b) "Sewage" shall mean the combination of the water-carried wastes from residences, business buildings, institutions, and industrial establishments, together with such ground, surface, and storm waters as may be present.

(c) "Public Sewer" shall mean a sewer controlled or maintained by the City.

(d) "Sanitary Sewer" shall mean a sewer which carries sewage and to which storm, surface, ground and unpolluted waters are not intentionally admitted.

(e) "Storm Sewer" shall mean a sewer which carries storm and surface waters and drainage, but excludes sewage and polluted industrial wastes.

(f) "Combined Sewer" shall mean a sewer which receives both surface runoff and sewage.

(g) "Building Sewer" shall mean the extension from the building drain to the public sewer or other place of disposal.

(h) "Sewage Works" shall mean all facilities for collecting, pumping, treating, and disposing of sewage.

(i) "Natural Outlet" shall mean any outlet into a watercourse, pond, lake, ditch, or other surface or ground water.

(j) "Industrial Wastes" shall mean any wastes from industrial processes as distinct from domestic sewage.

(k) "Person" shall mean any individual, firm, company, association, society, corporation, or group.

(l) "Biochemical Oxygen Demand" shall mean the quantity of oxygen utilized in the biochemical oxidation of organic matter under standard laboratory procedure in 5 days at 20 degrees centigrade, expressed in parts per million by weight.

(m) "pH" shall mean the logarithm of the reciprocal of the weight of hydrogen ions in grams per liter of solution.

(n) "Properly Shredded Garbage" shall mean the wastes from the preparation, cooking, and dispensing of food that has been shredded to such degree that all particles will be carried freely under flow conditions normally prevailing in public sewers with no particles greater than 1/2 inch in any dimension.

(o) "Suspended Solids" shall mean solids that either float on the surface of, or are in suspension in, water, sewage, or other liquids; and which are removable by laboratory filtering.

## Article II

## Use of Public Sewers Required

Section 3. It shall be unlawful for any person to deposit or cause to be deposited in an insanitary manner upon public or private property within the jurisdiction of the City of Kingsport any fecal matter or other objectionable waste.

Section 4. It shall be unlawful to discharge to any natural outlet within the jurisdiction of the City of Kingsport any sanitary sewage, industrial waste or other polluted waters except where such waters have been treated in a suitable treatment works, or unless the discharge to the natural outlet is permitted by the Division of Sanitary Engineering of the State of Tennessee Department of Public Health.

Section 5. Except as hereinafter provided, or as is provided in the "Plumbing Ordinances of the City of Kingsport", it shall be unlawful to construct, or maintain any privy, private vault, septic tank, or other facility intended or used for the disposal of sewage.

Section 6. The owner of all houses, buildings, or structures used for human occupancy, employment, recreation, or other purposes, including property where people are regularly assembled, situated within the City and abutting on any street, alley or right-of-way in which there is a public sanitary or combined sewer is hereby required at his expense to install and maintain suitable toilet facilities therein, and to connect such facilities directly with the public sewer in accordance with the provisions of this ordinance and the plumbing ordinance of the City of Kingsport within 30 days after date of official notice to do so, provided that said sewer is within 200 feet of the structure and of such elevation as to serve the structure, or property.

Section 7. At such times as a public sewer becomes available to a property served by a private disposal system, as provided in Section 6, a direct connection shall be made to the public sewer; and any septic tank, or similar private disposal facility, shall be abandoned and filled with material approved by the City.

## Article III

## Use of Public Sewers

Section 8. No person shall discharge or cause to be discharged any storm water, surface water, ground water, roof runoff, subsurface drainage, cooling water, or unpolluted industrial process waters to any sanitary sewer.

Section 9. Storm Water and all other unpolluted drainage shall be discharged to such sewers as are specifically designated as combined sewers or storm sewers, or to a natural outlet approved by authorities having jurisdiction.

Section 10. Except as herein provided, no person shall discharge or cause to be discharged to any public sewer any of the following described wastes:

(a) Any ashes, cinders, sand, mud, lime slurry, lime residue, straw, shavings, metal, glass, rags, feathers, tar, plastics, woods, paunch manure, paraffin, or any other substance capable of causing obstructions to flows in sewers or interfering with the operation of the sewage works.

(b) Any waters or wastes containing a toxic or poisonous substance in sufficient quantity to injure or interfere with any sewage treatment process, constitute a hazard to humans or animals or create any hazard in the receiving waters of the sewage treatment plant.
Materials such as iron, lead, copper, zinc, chromium, and similar toxic substances shall be limited in quantity so that the total contribution will not cause interference in any normal operation of sewage treatment.

(c) Any gasoline, benzine, naptha, fuel oil, mineral oil, or other flammable or explosive liquid, gas, or solid.

(d) Any waters or wastes which may contain more than 100 parts per million by weight, of fat, oil, and/or grease.

(e) Any liquid or vapor having a temperature higher than 150 degrees fahrenheit.

(f) Any waste having a pH lower than 5.5 or higher than 9.0, or having any other corrosive property capable of causing damage or hazard to structures, equipment, or personnel of the sewage works.

(g) Any waters or wastes containing suspended solids of such character and quantity that unusual provision, attention, or expense is required to handle such material at the sewage treatment plant.

(h) Any garbage that has not been properly shredded.

(i) Any noxious or malodorous gas or substance capable of creating a public nuisance or hazard.

(j) No polluted industrial waste from any source shall be permitted to be discharged into any sanitary sewer without the permission of the City, it being necessary to control the quantity and quality of industrial wastes thus discharged, since the primary function of the treatment plant is to provide for the treatment of domestic sewage.

Section 11. That the admission to the public sewers of any waters or wastes having a 5 day biochemical oxygen demand greater than 300 parts per million by weight, or containing more than 350 parts per million by weight of suspended solids, or containing any quantity of substance having the characteristics of those listed in Section 10 shall be subject to review and approval by the City. Where necessary, in the opinion of the City, the contributor shall provide at his expense approved preliminary treatment to reduce the biochemical oxygen demand, and/or suspended solids to the preceding limits, or reduce objectionable characteristics to within acceptable limits.

Section 12. Plans, specifications, and other pertinent data relating to proposed preliminary treatment facilities as mentioned in Section 11 shall be submitted for approval of the City and/or the Division of Sanitary Engineering of the State of Tennessee Health Department; and no construction of such facilities shall be commenced until said approvals are obtained in writing.

Section 13. That the discharge of waters and wastes to public sewers having discharge characteristics which require unusual provision, attention, or expense in any part of the sewage works, shall be subject to reivew and approval of the City. When necessary, in the opinion of the City, provisions shall be made to control rates of discharge by the contributor.

Section 14. Grease, oil, and sand removal facilities shall be provided by the producer when in the opinion of the City they are necessary for the proper handling of liquid wastes containing grease in excessive amounts, or any flammable wastes, sand, and/or other harmful ingredients. All interceptors shall be of a type and capacity approved by the City, and shall be located as to be readily and easily accessible for cleaning and inspection.

Where installed, all removal facilities shall be maintained by the owner, at his expense, in continuous efficient operation at all times.

Section 15. When requested by the City, the owner of any property served by the public sewer carrying industrial waste shall install an approved control manhole in the buidling sewer, to facilitate observing, sampling, and measuring the wastes. Such control manhole, when required, shall be accessible at all times to the City, safely located, and shall be constructed in accordance with plans approved by the City. The manhole shall be installed and maintained by the owner at his expense and shall be safe and accessible at all times.

Section 16. All tests and analyses of the characteristics of waters and wastes to which reference has been made in this ordinance shall be determined in accordance with the latest edition of "Standard Methods for the Examination of Water and Sewage" and shall be determined on samples taken from the control manhole provided in Section 15. In the event that no control manhole has been required, the control manhole shall be considered to be the nearest manhole downstream or other sampling place approved by the City.

Section 17. Highly colored wastes or waters which are of unusual volume, concentration of solids, or composition which may or may not pass through the sewage works unchanged are subject to review by the City for the approval of admission to public sewers, or modification or pretreatment at the point of origin to permit admission.

Section 18. Within 30 days after passage of this ordinance, all users of the public sewers who discharge industrial wastes to the public sewer shall file with their request for a permit from the City a statement relative to their industrial wastes, which statement shall furnish all pertinent data including quantity of flow and a representative analysis of the waters discharged to the public sewers and any other information that may be required by the City or the Tennessee State Health Department.

Section 19. Within 30 days after passage of this ordinance, all users of public sewers whose wastes are admissible to the sewers, but because of above normal concentrations as compared to normal domestic sewage and/or waste due to water not purchased from the public water supply shall be subject to a sewer service charge, and shall enter into an agreement with the City for the disposal of wastes subject to conditions as may be determined.

Section 20. The volume sewer service charge for customers inside the corporate limits of the City of Kingsport for wastes due to water not purchased from the Kingsport Water Department shall be as follows:

| Gallons | Per Thousand |
|---|---|
| First 2,500 | $ .30 |
| Next 22,500 | .15 |
| Next 50,000 | .10 |
| Next 125,000 | .075 |
| All over 200,000 | .05 |

Minimum Charge of $0.75 per month.

The City may require that the customer provide at his expense approved metering facilities to determine the amount of waste subject to the volume sewer service charge. Such metering facilities shall be accessible to the City during working hours. The customer shall bear the cost of maintaining, repairing, and testing of such metering facilities as the City directs. In lieu of approved metering facilities, the customer shall present data acceptable to the City whereby a representative sewer charge may be made. The data shall include the average daily amount of waste and the maximum daily amount which may be anticipated. The City reserves the right to have the customer conduct such surveys or to conduct such surveys itself as the City elects, to verify the data. Such surveys are to be conducted at least once a year by the customer and at other times as the City directs. The City reserves the right to have the customer install approved metering facilities in order to determine and control the volume of discharges into the public sewer.

Section 21. No statement contained in Section 20 of this ordinance shall be construed as preventing any agreement or arrangement between the City and any person whereby a waste of unusual strength or character may be accepted by the City for treatment, upon the payment by the person of an addition charge for such service.

Section 22. The City shall, after due notice, have the right to refuse sewer service to a person if it is found that a particular waste whose character, composition or volume is such that the sewage system fails in the performance of the prime function for which it was intended, (Same being the treatment of domestic sewage) even though the City has previously approved or accepted the waste for treatment.

## Article IV

## Powers and Authority of Inspectors

Section 23. Duly authorized agents of the City bearing proper identification shall be permitted to enter upon such properties as may be necessary for the purpose of inspecting, observing, measuring, sampling, and testing, in accordance with the provisions of this ordinance, during reasonable working hours.

## Article V

## Penalties

Section 24. Any person violating any of the provisions of this ordinance shall be liable to the City for any and all expenses, losses, or damages resulting to the public or the sewage treatment plant of the City, by reason of such violation.

Section 25. Any person violating any provision of this ordinance shall be guilty of a misdemeanor, and upon conviction thereof, shall be fined not less than one dollar and not more than fifty dollars; and each day's violation thereof shall constitute and be deemed a distinct and separate offense.

Section 26. The City is hereby granted authority to discontinue city water and/or sewer service to any person who violates any of the provisions of this ordinance or who fails to make sewer service charge payments when due.

## Article VI

## Validity

Section 27. If any part, section, subsection, sentence, clause, or phrase of this ordinance is for any reason declared to be unconstitutional or invalid such decision shall not affect the validity of the remaining portions of this ordinance.

## Article VII

## Ordinance in Force

Section 28. Be it further ordained by the City of Kingsport, that this ordinance shall take effect from the after the date of final passage and publication, as the law directs, the public welfare of the City of Kingsport, Tennessee, requiring it.

________________________
Mayor

ATTEST:

________________________
City Recorder

Passed on 1st Reading______
Passed on 2nd Reading______
Passed on 3rd Reading______

Approved as to form and correctness:

________________________
City Attorney

# APPENDIX G

# BIOASSAY METHODS

# BIOASSAY METHODS

During the period 28 November through 17 December 1972, personnel from the National Field Investigations Centers-Cincinnati and Denver conducted static and flow-through fish bioassays on effluents discharged to the Holston River and the South Fork of the Holston River by three industries in Kingsport, Tennessee. Fish bioassays were performed to determine the toxicity of waste pollutants discharged into these waters.

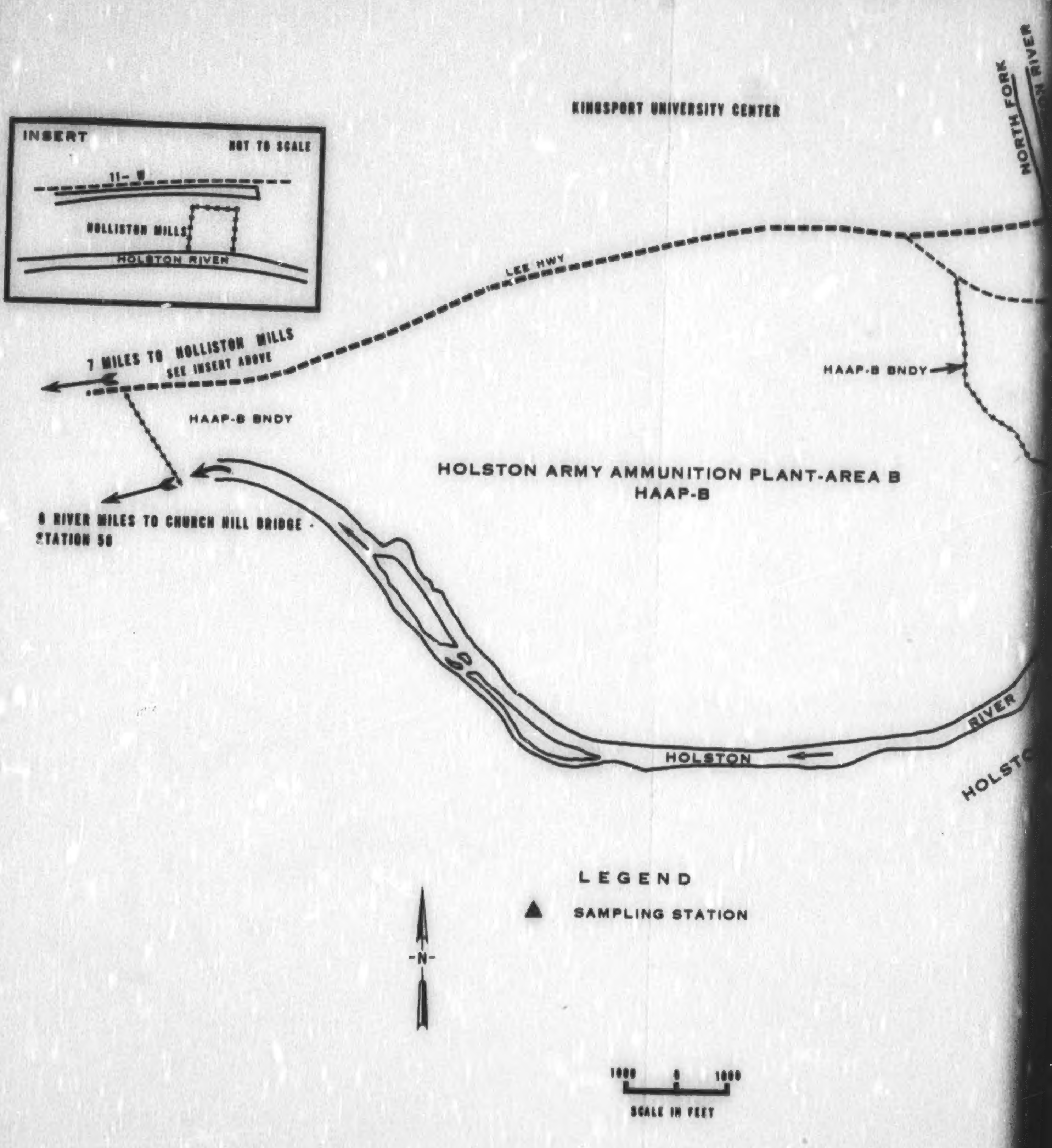
Samples of effluents used in the bioassays were obtained from five discharges at the Holston Army Ammunition Plant Area A (HAAP "A"), four discharges at the Holston Army Ammunition Plant Area B (HAAP "B"), and five discharges at the Tennessee Eastman Corporation Plant (TEC). Effluent samples from each discharge were assigned station numbers which are described in Appendix C of this report.

An initial grab sample was collected for use in a 24-hr screening bioassay test. A subsequent composite sample was collected during a 24-hr period for use in the full-scale bioassay. The amount of sample composited depended on whether a static bioassay or both static and flow-through bioassays were to be conducted. Ten gal. were composited in two five-gal. polyethylene carboys for a single static bioassay; 220 gal. were composited in four 55-gal. epoxy-lined metal drums for both static and flow-through bioassays. During the compositing of each sample, portions of the effluent were distributed equally between the containers to ensure uniformity in all containers.

Dilution water was obtained periodically during the study from the reservoir upstream of Fort Patrick Henry Dam located on the South Fork of the Holston River. This reservoir was upstream of all major sources of industrial and municipal discharge.

The bioassays were conducted in the NFIC mobile laboratory temporarily located at the Kingsport municipal Wastewater Treatment Plant. All effluents were tested for toxicity according to standard fish bioassay procedures.1/

Fathead minnows *(Pimephales promelas)* were used in the bioassays of all effluents. A duplicate set of static bioassays were conducted on two effluents (17 and 23) employing bluegill *(Lepomis macrochirus)* to further define toxicity.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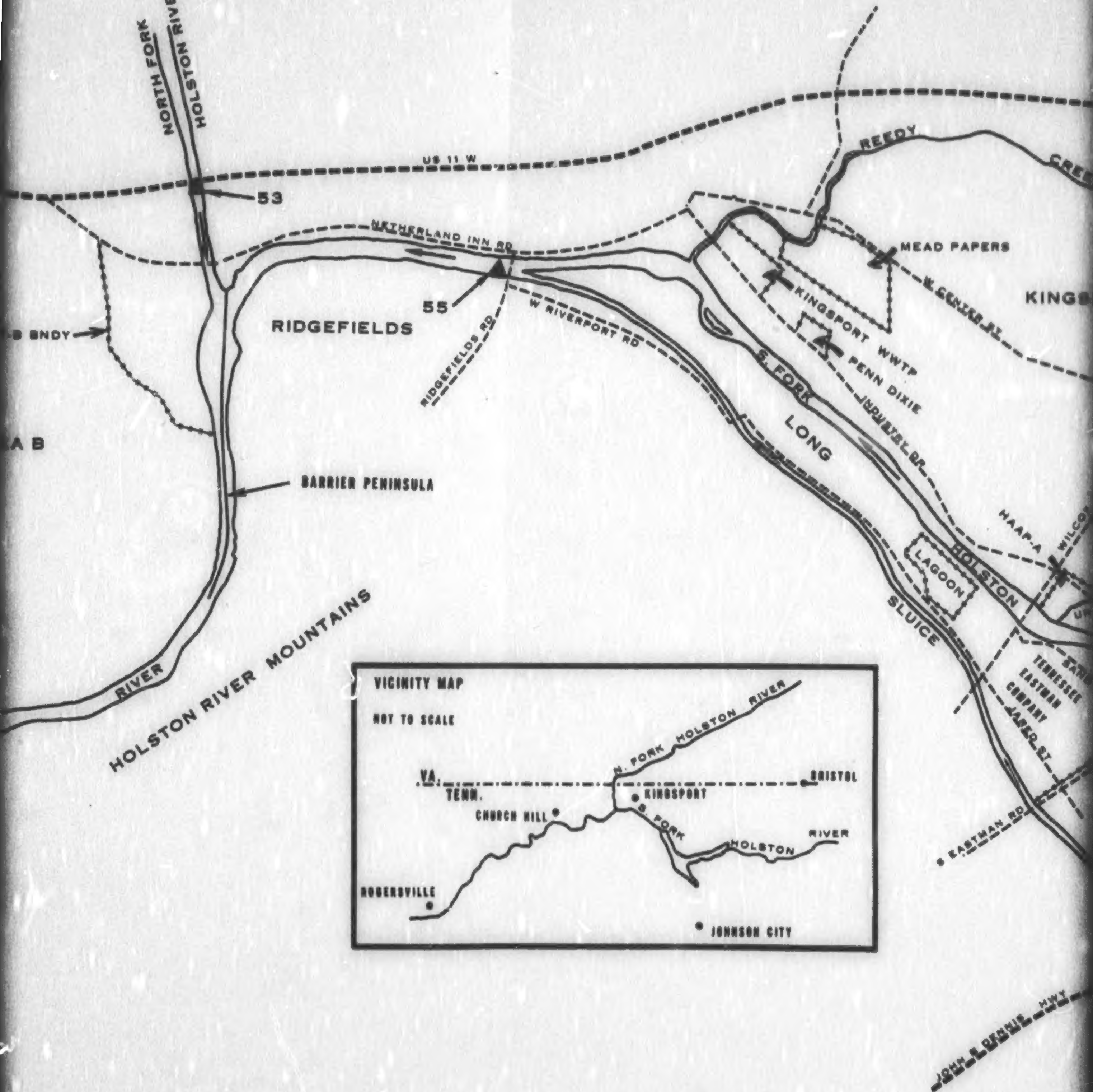
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S. FORK
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LAGOON
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JARED ST
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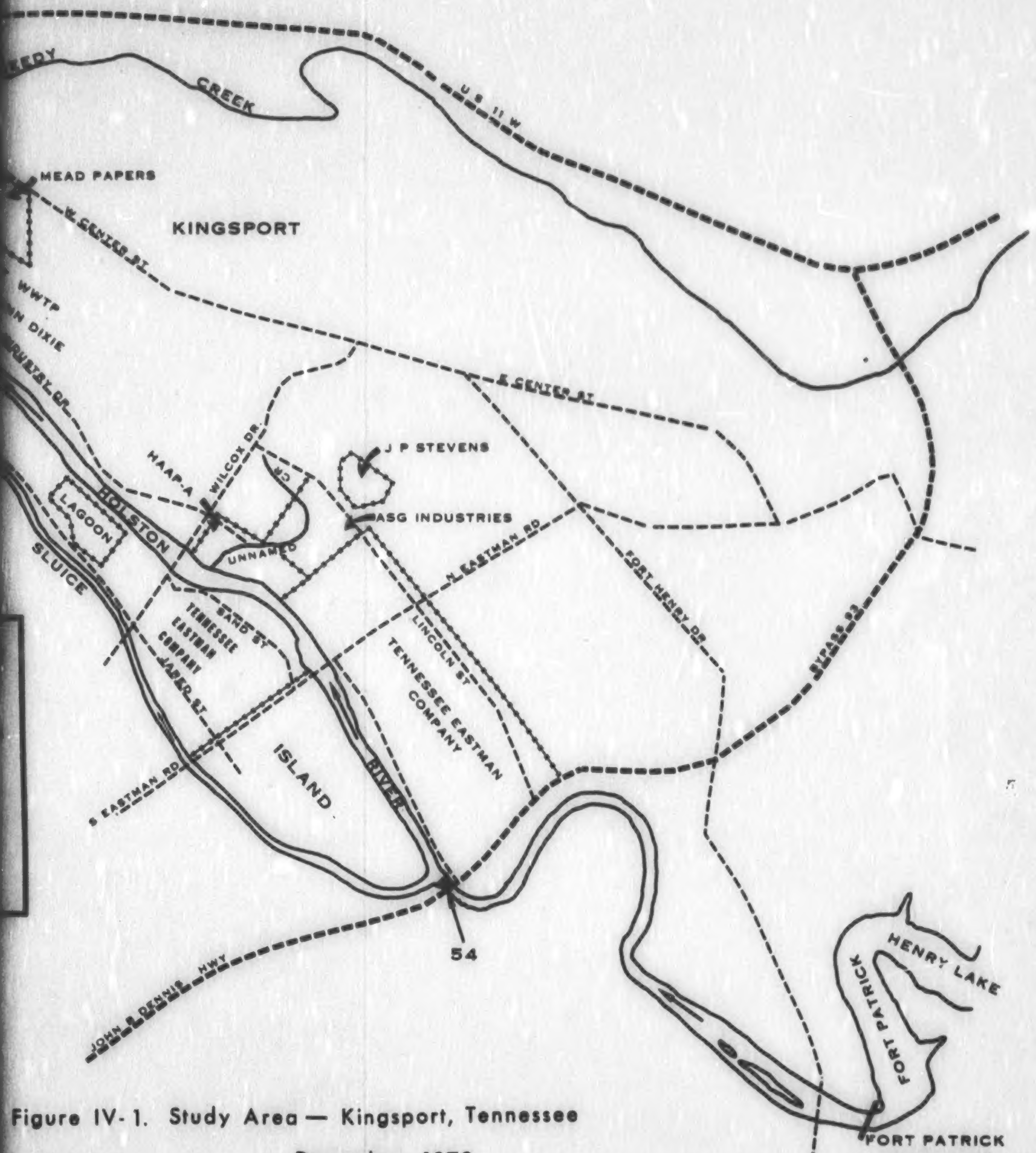
VICINITY MAP
NOT TO SCALE
VA.
TENN.
N. FORK HOLSTON RIVER
BRISTOL
KINGSPORT
CHURCH HILL
S. FORK
HOLSTON RIVER
ROGERSVILLE
JOHNSON CITY

Figure IV-1. Study

B

C-3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HAAP-A
WILCOX DR.
CR
ASG INDUSTRIES
LAGOON
HOLSTON
UNNAMED
SLUICE
N EASTMAN RD
FORT HENRY DR
BYPASS 93
SAND ST
TENNESSEE EASTMAN COMPANY
JARED ST
LINCOLN ST
TENNESSEE EASTMAN COMPANY
ISLAND
RIVER
S EASTMAN RD
54
JOHN B DENNIS HWY
FORT PATRICK
HENRY LAKE
FORT PATRICK HENRY DAM

Figure IV-1. Study Area — Kingsport, Tennessee

December, 1972

C